A Complex Systems Perspective on Multiple Language Learning: An Examination of Self-Regulation, Flow, Mindset, Grit, Expertise and Expert Performance

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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

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Abstract

Achievements in second language learning vary in magnitude from that of near monoglots, who might know a handful of words in other languages, to overachieving hyperpolyglots, who are fluent in at least six languages. Explanations for success in learning languages typically consider factors in isolation, and the result is too much faith being put into single causes. With the intention of considering a bigger picture, this mixed-methods research attempted to study and conceptualize factors as interacting nodes and hubs in a complex systems framework—the interactions of self-regulated learning (SRL), mindset, grit, flow, and expertise and expert behavior were studied as they related to levels of success in learning multiple languages.

Respondents completed an on-line questionnaire which consisted of demographic information as well as descriptions of language abilities. This was followed by psychometric tests including the Short Self-Regulation Questionnaire (SSRQ), the Flow State Scale-2 (FSS-2), the Theories of Intelligence Scale (TIS), and the Short Grit Scale (Grit-S). Once quantitative data was collected six respondents were asked to take part in the interview portion of the research. The subjects were chosen to represent a wide range of learners spanning the 'monoglot plus a little' level to the hyperpolyglot level. The semi-structured interviews were intended to elicit data to give more depth to the quantitative findings as well as to examine the expertise and expert performance framework.

Statistical analysis of 196 subjects show that the strength of the effects of SRL, mindset, grit, and flow were not as strong as hypothesized. However, the qualitative portion of the study involved interviews with six language learners and there are indications that the interaction of these fields might have more viability than the psychometric results would suggest. Additionally, the expertise and expert performance framework seemed valid as applied to the interviewees in that both quantity and quality of practice, as envisioned through the deliberate practice lens, seemed to mesh with their responses and achievements.

The interaction between the different systems proved difficult to measure based on the quantitative data, but the interviews gave insight into how these systems could interact. As stand-alone systems, SRL showed the clearest

influence on language learning, and the grit factor of consistency of effort proved to have a much stronger relationship than the grit factor of consistency of interest. Additional systems which could also be hubs are considered for future inquiry.

The contributions of this research go into several areas. First, the complex systems framework appears to be useful for considering achievement in second-language learning; next, the mixed-methods approach used in this study could be considered a starting point for future research; finally, there is an indication that language learners might possibly benefit from knowledge of the different factors covered in this study.

Contents

List of Abbreviations

CAS	Complex Adaptive System
CEFR	Common European Framework of Reference
FSS-2	Flow State Scale
FTP	Future Time Perspective
Grit-S	Short Grit Scale
ID	Individual Differences
KIIP	Korean Immigration and Integration Program
LA	Learner autonomy
LS	Learner strategies
PPLI	Perceived Positive Language Interaction
SDL	Self-directed learning
SLA	Second Language Acquisition
SRL	Self-Regulated Learning
SSRQ	Short Self-Regulation Questionnaire
TIS	Theories of Intelligence Scale
TOPIK	Test of Proficiency in Korean

> *Complexity theory may be exactly what applied linguistics needs in order to combine its various sub-disciplines in order to gain a more encompassing understanding of language and how it is acquired. Even if it seems a daunting task to purposefully embrace the complex, this conceptualization needs to be thoroughly investigated to determine its value for applied linguistics*. (Hensley, 2010, p. 84)

> *The emergent realm of complexity thinking answers that, to make sense of the sorts of transphenomena… one must 'level-jump'—that is, simultaneously examine the phenomenon in its own right (for its particular coherence and its specific rules of behavior) and pay attention to the conditions of its emergence (e.g., the agents that come together, the contexts of their co-activity, etc.).* (Davis & Sumara, 2008, p. 34)

1 Introduction

Systems of languages are intertwined with the human experience and the human experience has language systems ranging from nervous stammering in a native language to cosmopolitan expressiveness in multiple tongues. Systems of language manifest and influence individuals and society from the largest to the smallest of experiences and events. Indeed, there is perhaps no more personally relevant or clear an example of a complex adaptive system than language.

Languages are capital (Grin, 2001; Grin, 2003). Systems of trade, diplomacy, science, technology, travel, and courtship all require communication, and while some communication is possible through means such as numbers or pictures, language, both spoken and written, is the most expedient. Over the course of human history thousands of tongues have evolved and numerous vehicular languages have been used to meet the need for communication within and between communities, with polyglots providing a connection between those using different languages.

Polyglots are commodities in the global village. People who speak multiple languages command higher average incomes than monolinguals (Saiz & Zoido,

2002) and have additional competitive advantages in their careers (Grosse, 2004). The reality of this is reflected in the global language services industry which was estimated to be valued at over 46 billion U.S. dollars by the end of 2018 (Translation and Localization Industry Facts and Data, 2018). Acknowledgement of this is also seen through educational and governmental policies regarding languages as well as in human resource guidelines which subsidize language study for employees and favor job candidates who can speak more than one language (Shohamy, 2006; Nunan, 2003; Feely & Harzing, 2003; Angouri, 2014).

Further benefits of multilingualism exist in academics (Taylor & Lafayette, 2010), cultural understanding (Corbaz, 2005), health, cognition (Mehisto & Marsh, 2011) and increased self-esteem (Paradowski, 2011). Multilingualism allows for access to improved economic security and to personal well-being and satisfaction—it is a system which connects to many other systems.

With the human experience being intertwined with languages, and with the benefits of multilingualism being so strong, it is no surprise that we are looking for better ways to teach and to learn languages. Many separate aspects of languages and language learning have been researched, detailed, and delivered to language teachers and language learners; it is, however, unlikely that a single method, not considered in terms of its interaction with other systems, is the best way to frame the phenomenon of second language learning. The common idea of things being just a bit more complicated than we think could be productively considered as being a bit more *complex* than we think—language learning is a complex system with multiple interacting factors relating to varying degrees of success.

1.1 Background

My initial interest in languages, although I did not think of it as such at that time, was in grade four. My family had returned to Canada after a three-year period living in the United States and I found myself being outperformed by my peers in French class. From grade four to grade 10 I failed French every year, although I did manage to get sympathy passes in summer school for grades nine and 10 (grade 10 being my last public-school attempt).

As a university student with a newly developed sense of confidence, I took advantage of a government scholarship to study French in Quebec for a summer semester. My level test put me in the lowest French level, but four weeks after starting I was talking to an *animatrice* about Jules Verne as we compared English and French literature. While my French was not fantastic, barely adequate for a conversation about a topic that I knew, my classmate was astonished, and when he pointed out the conversation that I had been having I felt like I had awakened my language genius genes.

After graduating from university, I moved to Korea with the idea that I would become proficient in Korean after a year. Korean, however, kicked me in the head and left me groaning on the floor. I began to realize that language learning was more difficult than I had believed, and it was from that point that that I began to learn about learning, applying what I discovered to my own learning and teaching it to my students. Some of the ideas seemed to work, other ideas did not seem useful, and there was no magic bullet that I could find. Rather, I began to appreciate just how complex learning a language could be; I saw the different theories and ideas as, often, compatible and complementary, and I also realized that there was not a straightforward explanation for success in

learning additional languages—this was the opposite to what I had been taught throughout my life, where mystical things such as talent were called on for explanations of achievement or lack thereof.

Matters of human accomplishment have been viewed in different ways, perhaps simplistically, throughout history. Outstanding ability and inspiration in history, literature, and art was credited to the Muses by the ancient Greeks (Kaufman, 2012). As a modern theory this would not stand, as obviously unfalsifiable as it is, but it did offer power of explanation and would have alleviated feelings of culpability for personal mediocrity—if the heavens were not smiling on you what could be done?

From the Muses Western society moved on to the more modern version of genius and the concept of 'gifted.' A gift implies a gift giver, so the concept is a shift from the Muses to a parallel framework of another unfalsifiable notion–if a person shows exceptionality credit is given to mystical causes, while for the rest of humanity our lack of exceptionality is no fault of our own. *Que sera, sera*. 'Talent' is another oft-invoked term and is typically paired with 'giftedness.' The term 'talent' adds an air of respectability to the framework of an explanation for human abilities. It is used by researchers to refer to amorphous traits which the exceptional possess and the more commonplace of humanity lack; it is used by the general populace to justify mediocrity and cessation of effort (Dweck, 2006). Simple mechanisms of talent have not been found although research continues to look for causational rather than correlational genes to account for success in areas as diverse as music, art, and mathematics (Deary, Penke, & Johnson, 2010; Sui & Sleeboom-Faulkner, 2015). The finding of such genes would be a scientific revolution because it would not only give us the tools whereby talent

could be identified and nurtured early in life, it would also mean that the field of evolution would require restructuring—music, art, and mathematics have been with humanity for only a fraction of the time that evolution requires for the large changes on the genetic level that a strong conception of talent would necessitate.

The perceived catalytic component and explanation for exceptional performance, which in its upper ranges is called ‘giftedness’ or ‘genius,’ is used in relation to matters of the mind—the intelligence quotient (IQ). Its existence as an innate quality is unquestioned by many, coming as it does from the results of inscrutable tests and statistical measures pointing to the existence of a general factor of intelligence (*g*), which some see as an underlying trait for all areas of human cognitive endeavor (Wallace, Sisk & Senior, 2018). IQ scores correlate with social class, race, and country of birth (Nisbett et al., 2012). Although it could be considered that an IQ score is the product of the synergy of—among other factors—social class opportunities, stereotype threats, and national educational systems, it is considered by many to be largely genetically molded (e.g., Herrnstein & Murray, 1997; Plomin & Deary, 2015). Identifying those with a high IQ allows for a demographic focus on which to put our efforts to give those who are most privileged even more opportunities for development and success through the Matthew effect[1].

Happily, not all research into learning gets mired in the hopelessness of the predeterminism of innate talent, genius, or IQ. Research in language learning

[1] “For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath,” Matthew 25:29, KJV. Used in the explanation of how early success can lead to more opportunities for greater achievement, while lack of early success can take away opportunities.

considers additional elements such as communicative language teaching, mnemonic techniques, spaced repetition, and scaffolding. Research shows not only the effects of these on learning, but also how they can be improved for and by both teachers and students (Ellis, 1995; Nation, 2010). These elements, however, are separate trees in a forest—observing the trees is valuable but the trees need to be considered in relation to each other to appreciate the forest.

Complexity theory, or another of its guises such as complex adaptive systems (CAS) or complex systems, can bring everything together (Hiver & Al-Hoorie, 2016). Complexity does not negate other areas of research but reconceptualizes them. It minimizes pithy explanations for achievement by assigning varying degrees of importance to different systems and their interactions, with the recognition that other factors are also in play. Complexity theory suggests that accounting for skills development and learning is more complex than explanations analogous to being touched by a noodly appendage[2] or having a few advantageously inherited genes; complexity can be advantageously employed to explain degrees of success through a consideration of different schools of research and their applications to the human endeavor of language learning.

1.2 Significance of study

There are multiple areas of inquiry dealing with learning and skills development. These areas of research, however, show just a small part of the overall landscape—each, while important, can offer only a degree of explanation for a slice of reality. Considering how different areas of research

[2] An expression used by those conversant with the Church of the Flying Spaghetti Monster (see Henderson, 2010).

are related and how these relationships affect language learning could lead to a more comprehensive and effective approach to language acquisition. Findings from this approach could translate not only into better practices for the classroom but also serve to empower learners through giving the language learning landscape more detail and illuminating different influences and considerations for achievement.

Second language acquisition (SLA)[3] literature has a relatively small but important body of literature dealing with complexity (e.g. Atkinson et al., 2016; Dörnyei, 2009a; De Bot, Lowie & Verspoor, 2007; Herdina & Jessner, 2002). As of this writing, complexity in SLA deals primarily with the system of second language development in terms of the interplay of lexical features and grammatical functions as they are being acquired, framing second language acquisition as changes in complexity of a language system over time. While this is a valuable concept, applying the complexity architecture to SLA, can go in different, and perhaps more readily applicable, avenues.

The complexity framework is not largely considered in SLA as it applies to the mechanics, behaviors, and psychology that language learners tap to learn a language. Dörnyei (2017) discusses CAS in terms of learner characteristics, dealing with, among others, the traditional Big Five model[4], narrative identity, and characteristic adaptations. It is this last that has aspects which are related to CAS as they are dealt with in this study–a hitherto neglected area.

[3] It should be noted that while the term SLA refers specifically to learning one language in addition to a first language, it is also used to describe learning any number of additional languages (Gass & Selinker, 2009). Its usage in this paper conforms to this convention.

[4] A concept in applied psychology where personality is divided into openness to experiences, conscientiousness, extraversion, agreeableness, and neuroticism (see McCrae & Costa, 1987).

1.3 Theoretical Framework

> *… in revealing talent to be a process, the simple idea of genetic giftedness is forever debunked. It is no longer reasonable to attribute talent or success to a specific gene or any mysterious gift. The real gift, it turns out, belongs to virtually all of us: it is the plasticity and the extraordinary responsiveness built right into basic human biology*. (Shenk, 2011, p. 56)

In this study concepts such as giftedness, talent, and IQ are rejected as necessary mechanisms for high levels of human development, and the lack of the same are not seen as insurmountable blocks to growth. A negative view is taken of their acceptance as inviolable truth and an agnostic view is taken towards their existence; however, whether they exist, the belief in these concepts, often problematically, influences learners.

Belief can lead to failure through the self-fulfilling prophecy effect (Tuckman & Sexton, 1992). What language learners believe about language learning is of great consequence. As Riley (2000) states:

> What *they* [language learners; emphasis in the original] believe will influence their learning much, much more than what *we* [language teachers; emphasis in the original] believe, because it is their beliefs that hold sway over their motivations, attitudes and learning procedures. (p. 128)

The best materials, best teachers, and best opportunities will have little effect on students who view learning as hopeless and themselves as helpless. A typical individual, however, is possibly neither hopeless nor helpless but, rather, a victim of faulty assumptions.

Of course, just because something is detrimental does not mean that it is incorrect. There is the possibility that talent *could* exist, but the rationale for believing that it *does* exist as a stand-alone entity is not as robust as is generally accepted. Although there is a lot of research directed towards uncovering and 'proving' the role of talent in human development (Ericsson, 2007), its existence as a stand-alone entity is tautological—talent is seen to

exist because people with exceptional ability exist, and people with exceptional ability are seen to exist because of talent.

This research takes the view that 'talent' is analogous to *HC SVNT DRACONES*[5], an appeal to superstition which hinders exploration. If it does exist, innate talent is less likely to be a mystical dragon than a lounge of lizards. This research takes a pragmatic approach to the consideration of successful skills development in second language acquisition—effective second language acquisition is likely not the result of a single or even a small number of factors but exists as part of a complex system.

A complex system has numerous subsystems, and through consideration of some of these systems and their interrelationships a more complete view of successful second language acquisition can emerge. Within the complexity framework, ideally, all factors would be included for consideration. Such a task, however, is impossible. The fields of research included in this study have been chosen for their predictive power and utility as stand-alone entities in learning and skills development. Dörnyei (2005), in discussing individual differences (ID) in learning, makes the case that there are broad areas of psychology which apply to everybody, a 'normative blueprint,' within which individual learners develop. For the purposes of this research the broad areas to be covered are self-regulated learning (SRL), expertise and expert performance, flow, mindset, and grit.

To examine the effects of degrees of difference with the aforementioned fields to language learning, it is necessary to consider a wide swath of language learning accomplishments. Although simplistically categorized, monolinguals,

[5] Here be dragons. (Anachronistic) A label purportedly put on unexplored areas of medieval maps.

bilinguals, and trilinguals are relatively easy to find; somewhat less common, yet useful in understanding how far language learners can develop, are hyperpolyglots. Where monolinguals represent one extreme, hyperpolyglots represent the more extraordinary end of the spectrum. Deviations from the norm with this group, if consistent, could illuminate how the fields being considered might interact as a system to produce a result greater than its individual parts. It was anticipated that when the system of language learning is firing on all subsystems, when a Pareto optimum has been reached, the outcome is extreme language learning.

1.4 Purpose of Study

The purpose of this study is to ascertain the degree to which various systems are related to language learning and to see if these systems combine to refine one another as well as to come together synergistically as a greater whole. Through this it is hoped that both classroom practice and learners' approaches to second language acquisition could be informed.

1.5 Research Questions

The research questions to be answered are as follows:

1. What, if any, correlation exists between second language attainment of the fields covered in this research?
    a. Self-regulated learning
    b. Mindset
    c. Grit
    d. Flow
    e. Expertise and expert performance (deliberate practice)

2. How are these fields seen in learners of different levels of attainment along the spectrum of monolingualism to hyperpolyglottery?

1.6 Research Hypotheses

The hypotheses for the research questions are as follows:

H_{01}: There will be relationships between all fields and levels of second language attainment:

a. Self-regulated learning will correlate strongly with all other areas.
b. Mindset will correlate with all fields. A fixed mindset will be more apparent in subjects who speak one or two languages and a growth mindset will be more apparent in subjects who speak a greater number of languages.
c. Grit will weakly relate to the other fields because it is apparent only in difficult situations and such situations will be equally distributed amongst all participants.
d. Flow will correlate with all fields and be more apparent with the extreme of hyperpolyglottery.
e. Expertise and expert performance will correlate with all fields; greater degrees of purposeful and deliberate practice will be apparent with subjects who have attained greater second language mastery.

H_{02}: Those with greater facility and range for learning languages will show more complexity in the fields being researched.

1.7 Thesis Overview

The areas covered in the complexity framework used for this research, SRL, expertise and expert performance, flow, mindset, and grit, are detailed in section 2. A description of how these fields relate to general learning and skills development, as well how they relate to SLA, is presented. Additionally, hyperpolyglots are introduced and defined.

Following this is an explanation of the research methodology, including an overview of the psychometric instruments used (section 3). Subject selection is explained, rationale for the psychometric instruments is given, and a description of the data is presented.

Section 4 presents the results of the data collection. A description of the statistical measures is followed by the results of these measures. This is followed by a presentation of the data obtained through the interviews.

Section 5 provides a discussion of the results. A consideration of reasons for different findings are given and other systems of interest which were uncovered during the research are examined.

Finally, a consideration of issues in the research, possible applications, and ideas for future research are given (section 6).

2 Literature Review

As a teacher I have regularly introduced my students to ideas and research that I felt would positively influence their learning. Factors I have taught, and which were considered for inclusion in this research included goals and goal setting, motivation, procrastination, time management, issues of access, socioeconomic status, etc., (the list is long). Not all these factors could be included in the present study because of, primarily, time—how long would participants be willing to sit in front of a computer and do questionnaires? How long would they be willing to sit for an interview? For various reasons most factors had to be, reluctantly, taken off the list.

To cull the factors, coverage was considered—did some factors overlap with others? If so, these factors might be apparent from within the context of other factors. Of the ideas which I taught to my students some factors seemed to have clear analogs. For example, goals and goal setting is a factor in flow, SRL and deliberate practice; motivation is related to flow, mindset, grit, and SRL. As such, goals and goal setting, and other factors with similar relationships, were removed from the list.

Some factors, such as socioeconomic status, were felt to be too diffuse (absolute or relative socioeconomic status, for example, would need to be considered because of the different cultural and national backgrounds of the participants) as well as seemingly too intrusive to inquire about. Indeed, initially this project was conceived as having questionnaires translated into different languages in order to get data from different countries and different socioeconomic strata within each country. This idea, and others like it, had to be discarded as they were far too large to be covered.

Ultimately, SRL, expertise and expert behavior, flow, mindset, and grit were chosen for inclusion. Additionally, complexity theory was adopted to provide a framework within which these concepts could be held together. Finally, hyperpolyglots were included as it was felt that they could exemplify the interaction of these systems.

Reviewing a single field in a limited number of words is challenging, and when complex systems is superimposed over multiple fields a comprehensive review becomes impossible. This is because not only does complexity itself require an overview, each of the various included systems and subsystems—self-regulated learning, expertise and expert performance, flow, mindset, and grit—also need attention. It is not feasible to give each field exhaustive treatment.

In this literature review consideration of the different fields is, of necessity, restricted in scope and each retains only salient features to contextualize this research. Keeping with the central principles of complexity, definitions and descriptions will not be given with strict parameters. A CAS is, by nature, constantly evolving, meaning that any strict definition would be, at best, only accurate for a point in space and time. Fuzzy definitions are both acceptable and appropriate.

2.1 Complexity Theory

Complexity theory is a widely applicable approach to research which has been and is increasingly being utilized in various fields. Its breadth of application shows its versatility in framing academic research and is the reason why complexity is considered suitable to use across disciplines (Jacobson &

Wilensky, 2006). There are, however, some issues with using complexity theory for inquiry. One issue with complexity theory is that it has a multitude of definitions and understandings as “any definition of complexity is beholden to the perspective brought to bear upon it” (Manson, 2001, p. 405). As such, it is necessary to be familiar with a general overview of complexity before considering its uses in second language acquisition. Additionally, complexity theory, or complex adaptive systems, is often used to describe the evolution of a system over time, making its application in describing a moment in time, the primary way it is used in this research, a means of conceptualization as a metaphor rather than an explanation of an evolving process.

Complexity theory also does not allow for clear-cut explanations of phenomenon. This can be a concern because “people harbor deep-seated resistance toward ideas describing various phenomena in terms of self-organization, stochastic, and decentralized processes,” (Jacobson & Wilensky, 2006, p. 14). Despite this, complexity theory was chosen for this research because simple answers to complex questions about second-language learning, while satisfying, are not sufficient; they are akin to telling budding mechanics that a car runs because of fuel injection—it might be true for some cars, but it is only one of many factors, and that single fact is not enough information from which to expect anybody to become a successful mechanic.

2.1.1 Background

Complexity is the “inter-relationship, inter-action and inter-connectivity of elements within a system and between a system and its environment” (Chan, 2002, p. 1). Complexity is different than complicated in that something complicated can be accurately described and understood through reducing it to its parts, whereas something which is complex cannot be completely grasped

thorough a consideration of its components and must be considered as a whole (Reitsma, 2003). While this may seem like a timeless idea, it is difficult to say exactly when the study of complexity, as its own field, began.

Complexity thinking, although not labeled as such, has existed as a concept for a long period as shown in the old proverb “For Want of a Nail,” which relates to sensitive dependence on initial conditions and large effects resulting from small factors. In a more academic vein, the interaction of variables to produce a whole is apparent with, among others, the ideas of Vilfredo Pareto and Pareto efficiency, in that Pareto efficiency deals with interconnected influencing factors. A more modern version of complexity, cybernetics, is said to have begun to develop in the 1940s and 1950s (van Gelder & Port, 1995). After this came Edward Norton Lorenz and his idea of the butterfly effect (discussed below), which describes chaos theory. *Modeling of complex systems: an introduction* (Vemuri, 1978) was published, giving a more complete treatment of complexity, and finally, in the 1980s came the Santa Fe Institute, where scholars from various fields began working together to focus on synthesizing diverse disciplines. George Cowan is credited with the idea behind the Santa Fe Institute, and he placed the original conception to some ruminations that he had in 1956 (German, n.d).

The primary strength of complexity theory is that it gives a more accurate view of reality than is possible through a consideration of discrete factors (Eidelson, 1997), and this helps to contextualize success. That is, while it may be tempting, for example, to credit a person’s success to ‘hard work,’ the hard work in question has combined with a number of different factors, such as opportunity, timing, and access, meaning that it is just one factor among many; additionally, it is certainly possible to be successful, depending on one’s

definition of success, without hard work. Hard work, of course, can be studied and its effects considered, but by viewing it in isolation only a part of the story can be told, and the overall story arc cannot be fully appreciated. Examples of this are abundant in our lives, and any human considering the chain of events which led, for example, to reading these lines right now, would not be able to unpick how the plans, vagaries, and shifts of life have contributed to this moment.

While recognizing that things are complex is relatively easy, there are issues beyond that. Sanger & Giddings (2012) say that "The most basic concept [of complexity theory] is that there are differences between simple and complex systems, with the corollary that ideas useful in understanding simple systems may not be adequate to understand complex systems" (p. 2). Approaches to research in complex systems are varied and not always, or even often, easily applied. Additionally, complexity thinking requires an acknowledgement of the impossibility of understanding, or even realizing the existence of, all factors involved in phenomena.

Nevertheless, "Complexity theory provides numerous frameworks to view phenomena in different ways" (Gear, Eppel & Kozial-Mclain, 2018, p. 2). In the social sciences, and particularly in second language acquisition, complexity can be used a metaphor, although some details are lost (Larsen-Freeman & Cameron, 2012). Although imperfect, complexity theory and its kin have a powerful contribution to aid the understanding of second language acquisition.

2.1.2 Concepts relevant to complexity theory

Manson (2001) divides complexity theory into three types: the first, algorithmic complexity, is used in mathematical and informational fields; the second, deterministic complexity, is perhaps the most known as it is associated

with chaos theory and deals with system stability punctuated with periods of sudden change; and aggregate complexity, which deals with how different constituents interact and produce new systems. Of these three it is the aggregate complexity that Manson describes which is most applicable to this research, although aspects of his other definitions can also be usefully applied.

Manson's framework is attractive due to its simplicity, but simplicity in a description of complexity, while possible, seems antithetical to the idea of systems. Reitsma (2003) gives more details which clarify complexity as well as making its applications clearer through a more intricate consideration in which complexity is divided into seven types: deterministic complexity, statistical complexity, phase transition, chaos derivatives, connectivity, system variability, and relative and subjective complexity. Of importance to this inquiry are statistical complexity, connectivity, and system variability.

Statistical complexity deals with patterns and, according to Reitsma, randomness means maximal complexity. This is an important consideration because weak patterns can be the event horizon of a larger system. That is, in an infinitely complex system observation can only reveal finite phenomena and the more obvious patterns can be easily observed while those harder to discern are on the edge of what can be known but are no less a part of the whole—statistical complexity directly leads into phase transitions where chaos and order meet and where new systems arise. Chaos is the disorder from which new systems arise because it is in chaos where possibilities are at a maximum (Lefebvre & Letiche, 2014).

Connectivity is of great importance to envisioning complex systems of interaction. Holland (2006) describes agents as systems of systems, and it is the interaction of these systems which determines how agents act, react, and

evolve. Some agents have relatively little impact on others while some have relatively more. A useful concept is that of nodes and hubs. In a distributed system all nodes would be equal in influence and importance, such as computers in a peer-to-peer (P2P) network, but systems often have hubs which assume more importance, such as an internet service provider (ISP). If one, or even several, nodes go offline in a situation in which there are many nodes there is no discernable effect on the P2P system and files will transfer normally, while an ISP going offline can have a profound effect on all the nodes which connect to it and completely stop the network. The starting point of this research is possible hubs and a consideration of their contributions and interactions. The hubs (self-regulation, mindset, grit, flow, and expertise and expert performance) are described in their respective sections.

System variability is useful in understanding complex systems as envisioned in this research. Variability, when increased, leads to greater complexity. While increasing complexity makes inquiry more difficult, it also makes it a more accurate model of reality. Whereas outliers are often considered undesirable in research, here outliers are considered as systems of potentially greater complexity, and an examination of them could provide insight into language learning. The outliers in this research are the hyperpolyglots and how they differ from the norm, or perhaps more aptly how they show different patterns than the norm, is of interest in this study.

Understanding these basic ideas of complexity theory is the first step. The next is choosing the best term to use as complexity theory has many labels which are often used synonymously. Systems, dynamical systems, complexity, complexity theory, complexity science, complex systems, and complex adaptive systems are used throughout the literature, and providing details of the specific

parameters of each definition would be a formidable undertaking. This is compounded when many terms are used interchangeably to refer to the same phenomena. Gell-Mann, in describing the use of different terms, states that “a scientist would rather use someone else's toothbrush than another scientist's nomenclature” (1995, p. 20)—trying to tame this unruly system of jargon is outside the purview of this review. Rather than unpacking all the terms it is more practical to choose one to rely on and to consider the others as synonyms.

Complexity can be used as a broad term with a complex system being a system which shows complexity. The components of complexity are interacting agents, self-influencing feedback, adaption, being subject to environmental influence, emergence of new systems through evolution, self-organization, and movement between order and disorder (Johnson, 2009).

Providing a shade of definitional distinction is complex adaptive systems. CAS refers to a system which changes in relation to its environment over time and is closely intertwined with other associated systems (Chan, 2001). CAS is a general term used by numerous researchers in both education and SLA (e.g., Gilstrap, 2005; Hensley, 2010; Morrison, 2008; Stirling, 2014) and has been in use, in some form, since at least the 1960s where it was used by Walter Buckley (1969) in his argument that sociology should draw on CAS to better research the field, contending that traditional models require a view of stability that belies the change and variability of society. His explanation of CAS, which he describes as a paradigm, has many of the key features which are being used in contemporary definitions. CAS, according to Buckley, means that a system has sensitivity to outside influence, has a means of introducing variety, a means of discrimination for the new variety, and can keep and proliferate these new varieties.

Dooley (1996) presents a nominal definition of CAS because, “no one has bothered to create a nominal definition to define what a complex adaptive system is” (p. 2). Dooley’s description draws on multiple sources to create his definition. Because it is a nominal definition it maintains an amount of fuzziness in that it explains the properties of a CAS rather than giving a precise meaning; this is, of course, appropriate for the field.

Dooley describes CASs as having semi-autonomous ‘agents’ which are composed of schemas, which themselves are evolved from or contain smaller schemas. These schemas interpret reality and determine response. When there is a mismatch between observation and expectation the agent can adapt the schema. Additionally, schema can evolve randomly or in conjunction with other schemas. Fitness determines the robustness of new schemas and unfit schemas tend to originate change. These schemas determine how agents interact and subsequently how information flows between agents.

Dooley’s nominal definition can be simplified—there are multiple processes and influences going back and forth between agents and these processes and influences are internalized, marginalized, and recursive, leading to ongoing evolutionary processes—change over time is an intricate dance of interactions. The view of CAS given by Dooley, and generally used in the literature, refers to change over time. This inquiry, however, is not looking at change over time but rather considering a snapshot of a point in time and is akin to looking at the fossils of different strata and considering the homology but realizing that each represents many possible antecedents and a future with different descendants.

The nominal definitions of complexity are helpful in that they give some shape to considerations of what and how to approach research. It is still

necessary, however, to consider some of the other aspects of complexity to appreciate its application for second language acquisition in this study. Nodes, hubs, and agents have been described above, however, there are many aspects which both overlap with, refine, and relate to these ideas that are of importance in this research: nonlinearity, synergy, emergence, divergence, and attractors.

Nonlinearity is an essential aspect in understanding complexity. Nonlinearity refers to a key aspect of CAS–outcomes and developments cannot be predicted with a great deal of accuracy over time. The most well-known example of nonlinearity is the butterfly effect, which is used to describe how very small influences can have very large effects and is usually described through variations on the idea of the flapping wings of a butterfly in Brazil leading to a tornado in Texas (this version is used by Eidelson, 1997). Expected outcomes of various endeavors might not be achieved while unexpected outcomes are commonplace. In second language acquisition this often seems to be the norm (unless, as the more cynical language teachers might say, the expected outcome of language classes is that students will *not* make great strides in learning a second language). Nonlinearity is coupled with the concept of a strange attractor, discussed below.

Synergy, the whole being greater than the sum of its parts, is a large part of the understanding of CAS. Synergy refers to the inseparability of a complex system from its components (Baicchi, 2015). For example, water has many properties and uses which cannot be determined or understood if its components of hydrogen and oxygen are studied separately. Indeed, hydrogen is combustible and oxygen is an accelerant, so water, at least when considered on a superficial level, could be expected to cause a conflagration if dumped

onto a fire, whereas it does the opposite. This is an important consideration in language learning because the differences in attained levels of second language ability are diverse. In situations where there is equal access and instruction why do some greatly outperform others? Why do some language learners seem to learn easily while others struggle? The simplistic answer is that some people are smarter but that does not explain why some people become proficient at languages at seemingly random points in their lives nor why some 'smart' people are not good at learning languages. It is tempting to ascribe simple reasons such as interest, learning styles, or a general failing of the public-school system, and these could be part of the reason, but it is important that the 'part' part be emphasized. This is of interest when we consider that in many cases language learners in the same environment with the same social influences and the same opportunities do not achieve the same levels of success despite what a simple view of linear causality would indicate. Nonlinearity is, simply, a description of the fact that outcomes are not as would be predicted based on available information and, often, expectations.

Connected to synergy is emergence. Emergence relates to new actions and behaviors which emerge "from the interactions of the parts" (Holland, 1992, p. 20). So, synergy is the interaction of the parts while emergence is the outcome of the interaction. Emergence, seen this way, is the evolution of something new based on its antecedents, a new system of systems, although emergence is not necessarily one system changing into a single different system but can entail a system changing into a greater number of systems in a dramatic manner. This divergence is called bifurcation (or phase transition) and is an important part of CAS. A very small change in value through successive iterations will show little difference until a point is reached and values diverge

dramatically (more properly, the orbits double). This is part of the concept of 'sensitive dependence on initial conditions' and is one key to understanding how seemingly similar situations (or people) can diverge widely from expectations. Why, for example, can two members of the same family, sharing massive genetic similarity and a comparable environment, diverge so widely? The answer, according to CAS, is that it does not require much difference to lead to massive variance.

Not all in CAS, however, deals with extreme difference of outcomes. Attractors deal with, in different ways, convergence of systems and outcomes. Of interest to this inquiry are fixed point attractors (as well as the unstable points known as repellers), and strange attractors.

Fixed point attractors are the most intuitive of the attractors. Simply, a fixed-point attractor is a state to which actions (or systems), whatever their initial parameters, come to rest (Goldstein, 2011). In the natural world there are any number of examples such as a ball rolling down a hill, where the fixed point is the bottom of the hill, a satellite falling to earth, where the fixed point is the earth, or the death of an organism (*turritopsis dohrnii*[6] and its ilk excepted), where life ends in death. Fixed point attractors are attractors of the inevitable. With caveats, it can be considered that native-language fluency is an attractor state—people from a wide range of backgrounds, opportunities, and interests learn to speak a native language.

An unstable fixed point is a useful concept to apply to research. Repellers can be a stable state in a condition where variables remain constant, but any small change in variables results in a situation where iterations of a condition

[6] *turritopsis dohrnii*—a species of biologically immortal jellyfish

move away from that point (Ashwin & Timme, 2005). A clear example of this in the physical world would be an egg balanced on top of another egg. It is possible to balance eggs in this way, but any small vibration or puff of air will result in the eggs moving away from this state.

Finally, there are strange attractors. With a strange attractor there is no fixed point at which values in a system will converge but, rather, with a strange attractor there is a range around which values fall, meaning that any small change in initial conditions will lead to a different trajectory for the evolution of any system but it cannot be said that outcomes are completely different or random as the values all circle around the same central range. In the physical world a strange attractor could be the orbit of asteroids where the asteroids orbit the sun but are constantly changing position in relation to one another and, as well, never striking the exact same orbit twice.

2.1.3 Complexity in research

The overview of concepts of complexity in the previous section should not be considered complete. It is, rather, a general overview of ideas that apply to the use of complexity in different fields. Research which uses complexity includes, among others, physics, biology, meteorology, sociology, education, and SLA. Castellani (2013), in his Map of the Complexity Sciences, has over 25 different sciences included. It is clear why complexity can be called the ‘science of all sciences’ (Johnson, 2009).

In the hard sciences the approach to complexity can use math to give visualizations and models with which to frame understanding. Such models can be used in the soft sciences, but with the increased difficulty of differentiating variables the math of systems becomes convoluted. That does not lessen the utility of complexity; rather, it leads to complexity being adapted and used

differently. The number crunching of complexity theory, which is to a degree possible in the hard sciences, is attractive because numbers make even complexity seem concrete; in the social sciences, however, numbers remain somewhat less crunched (although not completely) and complexity is often used differently in that "emphasis is placed on the metaphorical or conceptual application of complexity theory" (Sanger & Giddings, 2012, p. 369).

In the context of this research complexity is not used to make concrete pronouncements about outcomes based on a few variables (or systems), but to develop an awareness such as the type which Holland (2006) describes as the value of using exploratory computer models: "They help us build up our intuition for the mechanisms and interactions the program define" (p. 3).

2.1.4 Complexity in Second Language Acquisition

Complexity in SLA is not new, although it could be argued that it is underrepresented. In her 1997 paper Larsen-Freeman clearly sets out how complexity can be used to study SLA. Primarily, and foreshadowing much of the subsequent use of complexity in SLA, Larsen-Freeman focuses on language development as a complex system (what is often called interlanguage). That is, second language development shows, among other things, sensitive dependence on initial conditions, nonlinear development, and fixed attractors. It is this direction of complexity's use in SLA that became the primary direction of complexity with Larsen-Freeman herself publishing multiple articles and books as well as others such as de Bot, Lowie, and Verspoor following suit. Other considerations of complexity in SLA deal with language as an emergent system and considerations of agents in terms of grammar rules and human interactions (Beckner et al., 2009; Solé, Corominas-Murtra, Valverde & Steels, 2005; Hashimoto, 2012).

However, while the direction of complexity perhaps showed a sensitive dependence on initial conditions in SLA, there was a recognition that complexity could be used in different ways such as with ID in second language acquisition (Larsen-Freeman, 1997). This has been acknowledged by other researchers such as Dörnyei (2009b, 2017), by the Douglas Fir Group (Atkinson et al., 2016) and the Five Graces Group (Beckner et al., 2009).

One of the reasons given for using complexity to study ID in SLA is pragmatic: “Progress in understanding SLA will not be made simply by identifying more and more variables that are thought to influence language learners” (Larsen-Freeman, 1997, p. 156). As a field we know a good deal about different factors which affect learning a second language and, in many ways, SLA is a field which centers on refining these ideas rather than attempting to consider the whole. Dörnyei (2005) states, “examining the combined effect or interrelationship of personality traits and other ID variables may also yield meaningful insights” (p. 30)—considering individual differences as part of a complex system can show how different factors interact.

The Douglas Fir Group (Atkinson et al., 2016) expands the call for the use of complexity in SLA. They set out several areas which would benefit from the transdisciplinary aspect of complexity, although they fall short of outlining possible IDs as they relate to psychology or, specifically, cognitive psychology and positive psychology. Their primary focus is on language learning in society being influenced by macro structures including values, a meso level of identities and communities, a micro level of semiotic resources, and social levels of interaction. It is, however, easy to envision how other systems would interact in their framework. For example, a belief system which emphasizes hard work would influence individual choices for learning. Likewise, a school with bad

teachers could have a negative effect which permeates all levels of the systems which they outline.

The consideration of interaction across levels is attractive as it provides a base to consider sensitive dependence on initial conditions. Herdina and Jessner (2002) sum this concept up: “In DMM [dynamic model of multilingualism] we argue that aptitude is an emergent property of multilingual systems which is not directly predictable from genetic material or experience considered separately” (p. 117). Aptitude, in this case, covers many of the different psychological processes of learners.

Dörnyei (2009b) states that “currently we know relatively little about the interplay among language, agent, and environment in the language acquisition process” (p. 230). Importantly, Dörnyei mentions that most research in learner characteristics focuses on the differences between individuals and “stable and systematic deviations from a normative blueprint” (p. 231). It is unlikely that learners are in a static environment or a state of homeostasis and Dörnyei suggests that it could be fruitful to examine the relationship between the language, the agent (in this case the language learner), and the environment. This is not, however, the only way to consider language learners and the relationship between any systems and subsystems could be informative. This idea, broadly considered, is reflected elsewhere. De Bot et al. (2007) state:

> … a language learner is regarded as a dynamic subsystem within a social system with a great number of interacting internal dynamic sub-sub systems, which function within a multitude of other external dynamic systems. (p. 14).

When compared to Dörnyei this might seem amorphous and broad, but such is the nature of complexity—everything interacts and there is no limit to the

number of interactions between systems and nested systems, only in our ability to survey them.

More recent work in complexity in SLA has been published since this inquiry started. The newer works show an expansion of the application and conceptualization of complexity in SLA, and indication that complexity is moving to the mainstream of SLA.

In discussing intentionality, Kostoulas and Stelma (2016) use Complex Systems Theory (CST) as a framework. Their consideration describes the complexity of intentionality and how it motivates language learning. They explain how different sources of intentionality, for example, how a culture envisions language learning, can affect how smaller groups envision language learning, and how this affects learner intentionality. The resulting system has having come about through “shaping influences” (p. 11).

In explaining how complexity can be used in SLA, Hiver and Al-Hoorie (2016) give strong reasoning. They make the point that using the complexity perspective of “interconnectedness” and “multicausality,” and “discouraging determinism, reductionism, and precise (rather than probabilistic) predication, this new complexity agenda” (p. 743) gives a more effective view of second language development. Explanations for language learning that are too simple are not doing justice to the understanding of how people learn languages.

Some recent studies have used the complexity framework to directly research language learning. Serafini (2017) uses dynamic systems theory (DST) to consider individual differences amongst learners of Spanish, considering, amongst other things, the relationships between working memory, aspects of motivation, and language anxiety. In his dissertation, Evans (2019)

uses a longitudinal approach to follow the development of an individual's language over a year, showing that there is not a linear improvement in ability, with various factors interacting at various points in development to create a non-linear trajectory. This approach could perhaps be useful in future studies in language learning.

2.1.5 Inclusion in the study

While it is impossible to consider all the factors involved in the phenomenon of second language learning, examining constrained aspects is not wasted effort. Constraining the wider view of a consideration of all systems is a necessity because a complete view of all systems is not possible. In his 2008 discussion of the use of a dynamic systems approach to language learning, van Geert states that "it is strategically wise to conceptually reduce the complex system to a single dimension or a very simple state space" as this "opens the complex pattern for study and description" (p. 185). Although the butterfly effect shows that very small factors can lead to big changes, this does not mean that big changes cannot also be realized through other means—it is likely that there are 'big things' which can be clearly seen and considered.

Johnson (2009) makes a significant point dealing with this: to change the direction of a developing system a tweak might be all that is necessary; this tweak need not be big but, rather, timely. Additionally, we do not need to have access to or understanding of all the agents in a system, but a small tweak could advantageously be applied to a subsystem that we can access. Furthermore, even if we do not have access to any of the subsystems, change can be achieved by adding systems. For the present research this has a few potential ramifications. First, the systems that instructors have access to, such

as deliberate practice, can possibly affect the evolution of the system. Next, those systems that instructors do not have access to (the lives of students outside the classroom) can be affected with the addition of a new system (knowledge of SRL for example), putting the power and responsibility on the learners.

De Bot et al. (2007), in addition to the attractor metaphor, use the metaphor of a repeller (unstable attractor). That is, some states or systems are attractors into, or around which, systems move; other systems and states are repellers, away from which systems move. It is possible that previous research into learning could be considered in terms of attractors or repellers. For example, the positive psychology field of flow might be considered an attractor state, as is indicated by its explanatory power for the areas of motivation and persistence (Csíkszentmihályi, 2014a), but its effect could be amplified or mitigated in the presence of repeller states. For example, the fixed mindset of social psychology could be a repeller state and in a stable environment it could be beneficial, but any minor change could reverse this.

De Bot et al. (2007) also provide a useful framework for inquiry. As with any complex system, the system of language learning has far too many factors for all to be included. Indeed, there are more factors than have been considered in all research done to date, and, assuming the absence of supercomputers and artificial intelligence bent to the task, in all research that can ever be done. However, in giving necessary conditions for the growth of language systems De Bot et al. (2007) make the point that there needs to be both internal and external resources including, among others, motivational resources, learning resources, conceptual resources, and conducive environments. The present

research neither intends to give a comprehensive overview of the system of language learning nor is expecting to find that the areas being examined will conclusively explain the hows and whys of language learning. Complexity is used in this research for its explanatory power and usefulness in considering a wide range of interacting systems. It is impossible, as stated earlier, to account for every part of a system, so CAS is used to consider the systems and interactions of specified constructs which explain success in various areas of learning—some 'big things.' This is done to investigate if synergy can give a greater accounting for outcomes.

The hubs being considered in this research are self-regulated learning, mindset, grit, flow, and expertise and expert performance. Hyperpolyglots are considered a possible emergent state from a synergistic system which includes each of these.

2.2 Hyperpolyglots

Hyperpolyglots are important subjects in this study because they represent an expert profile which is both exceptional and under-represented in research. While for many learning a second language even to an intermediate level is a respectable accomplishment, hyperpolyglots learn multiple languages to an advanced level. In the past there were language learning virtuosos such as Emil Krebs, who was reported to have known between 60 and 70 languages (Amunts, Schleicher, & Zilles, 2004), and Cardinal Mezzofanti who was reportedly 'familiar' with 72 languages and 'fluent' in 39 (Robinson & Ellis, 2008). In the age of YouTube and social media modern hyperpolyglots are perhaps not as liable to having their exploits undergo the amplification of mythologizing, but there are impressive contemporary exploits of language

learning seen with, among many others, people such as Richard Simcott and Timothy Doner, both reputed to speak 20 languages or more (List of polyglots, 2016).

Michael Erard states that “These days, the world is ripe for hyperpolyglottery” (Erard, 2012, p. 215). The modern world has an increasing number of opportunities for people to become master language learners. There are limitless learning resources available on the internet, and the ease of travel afforded by the modern transportation system has created a playground of opportunity for some of the world’s more fortunate people. Internet communities of language learners are common, successful language learners, including hyperpolyglots, regularly upload videos to YouTube, and there is at least one well-attended annual polyglot conference (Polyglot Conference, n.d.) which features people who love learning languages.

2.2.1 Background

Hyperpolyglots have a wealth of information available on the internet and there are also a handful of books written by hyperpolyglots detailing their learning techniques, although these offerings, while interesting and insightful, are not academically rigorous nor do they delve deeply into underlying factors contributing to becoming a hyperpolyglot. Indeed, at the time of this writing Sankó, (2014) has the only academic treatment dealing directly with hyperpolyglots. He gives an overview of hyperpolyglot beliefs and their approaches to language learning through a consideration of materials produced by the polyglot community. His treatment is descriptive and broad rather than deep and is more of a call for further inquiry than an attempt to answer questions.

A much more in-depth look at hyperpolyglots, *Babel no More: The Search for the World's Most Extraordinary Language Learners* (2012), by Michael Erard, gives an excellent overview of what Erard describes as a 'neural tribe.' It is a journalistic work rather than an academic work, offering description and some conjecture rather than structured research, but nevertheless, it gives a clear picture of some individuals in this subculture. It is, currently, the most complete look at hyperpolyglots available as well as the primary source for those discussing hyperpolyglots.

2.2.2 Definitions

Hyperpolyglot, as a label, does not have a long history. Erard states that the term was first used by Richard Hudson around 2003 (Erard, 2006), but the term's relative popularization has come from Erard's own book, *Babel No More* (2012). There are not many other terms used to describe speaking many languages. One term is Cohen's (2014) 'super-multilingualism,' but he references Erard and uses his term synonymously with hyperpolyglottery.

There are also scattered internet references to superpolyglots, but aside from a short biography of George Borrow (Mencher, 1989) which uses the term once, and a pejorative use in a feminist work which uses the word in a discussion of Erard's (2012) book (Pandey, 2014), there are not, at the time of this writing, other references.

This makes the definition of a hyperpolyglot seemingly free of baggage as references to the phenomenon typically give one or both of Erard's two definitions: the first definition is that hyperpolyglots are people who can speak a minimum of six languages (Erard, 2006), and the second definition has the number of languages set at 11 (Erard, 2012). The revision to 11 came after

Erard had met with hyperpolyglots while researching his book and subsequently determined that six languages is not extraordinary amongst polyglots. Nevertheless, six languages seems to be the more common definition and HYPIA (the International Association of Hyperpolyglots), established in 2016, has adopted the six-language standard in its definition.

There is, however, the beginning of a definitional drift with this term. For example, Hudson gives the rather unprecise definition of “dozens of languages,” (Hudson, 2008, p. 90) but he is mentioning hyperpolyglots as an example of high language learning prowess rather than treating them specifically. Sankó (2014) mentions both six and 11. In this research the first definition, six additional languages, is used. This definition is, however, problematic in the details.

The question of what it means to be fluent in a language is a primary source of confusion. It is easy to say that a person speaks, for example, French, Russian, and Mandarin, but what does ‘speak’ mean? Does it mean the ability to get directions to a train station? To successfully woo a partner? To make a presentation about the cecal valves of lizards from Pod Kopiste? Does it mean to do each or all the previous with a ‘native-speaker’ accent (a definition of which would further muddy the waters)? Does it mean to speak a language using contemporary slang and jargon? Or does fluency not require speaking at all, but rather would it be satisfied with any one or two skills of writing, listening, or reading?

To further compound the issue, how are the components which constitute fluency evaluated and how reliable are such evaluations? There are, for example, groups of people who can score well on standardized tests but have

dubious ability with the language for which they are tested (Choi, 2008). There are also people who are considered completely bilingual even in the absence of a formal evaluation, such as the bilingual French/English speakers in many parts of Canada who often need no formal certification to get jobs requiring fluency in both languages.

There is an additional problem of using a discrete number to enumerate languages spoken. Can a Dutch speaker be said to speak an additional language if that language is Afrikaans or Frisian? Can Swedes claim to speak Norwegian as a second language? Is a Glaswegian who can slip into Cockney not considered bilingual due to definitional conventions?

This morass of issues requires that concessions be made. In acknowledgment that there are multiple points of overlap and divergence between concepts of fluency, evaluation, and of language itself, the definition here will consider the concept broadly.

Hyperpolyglots, according to Erard (2012), have their own gauge for language ability:

> I asked what it meant to 'know' a language. Most people replied that you had to do be able *[sic]* to do things in that language: talk to natives, express oneself, consume media… they focused on comfort at functional abilities: one must know how to speak, read, and write 'intelligently,' 'without major difficulty,' and 'without feeling that I have to avoid any theme or activity.' (p. 56)

This is similar to the Independent user level of the Common European Framework, which includes levels B1 and B2 (Council of Europe, 2001, p. 24). Benny Lewis (aka Benny the Irish Polyglot), a polyglot with partial skills in at least 20 languages and fluency in at least six (enumeration of languages is difficult because many hyperpolyglots do not make lists) says that B2 is what he considers the level required to be considered fluent (Lewis, 2014). Gabriel

Wyner, a language learner who speaks around six languages (Wyner, 2017) says about 'fluency' that "The term is imprecise, and it means a little less every time someone writes another book, article, or spam email" (Wyner, 2014, p. 6). For the purposes of this research hyperpolyglots will be considered as people who speak six or more languages at the B1 level.

2.2.3 Inclusion in this study and possible interrelationships

Hyperpolyglots are a nearly untapped resource for illuminating success in second-language learning. Indeed, there is a baffling lack of scholarly interest relating to hyperpolyglottery:

> Unfortunately, because linguists have been most fascinated with the acquisition of native-like skills, more is known about people who are able to learn one or two more languages very deeply rather than about those who can acquire a good working knowledge in a larger set. (Erard, 2012, p. 180)

This is a strong point because the field of second-language acquisition, by name, indicates an emphasis on the acquisition of *one* additional language, and, despite the definition of second-language acquisition being inclusive of learning a third, fourth, fifth, or even more languages (Gass & Selinker, 2009), relatively little published work is available on massive language acquisition.

This lack of research is possibly reflective of how we look for genius rather than hard work and how we use pithy explanations for high achievement. Erard (2012) says:

> I also had to confront why language scientists have refused to consider hyperpolyglots, talented language learners, and language accumulators as anything more than curiosities or freaks. (p. 13)

This paucity of interest in hyperpolyglottery is echoed by Sankó (2014), who states that in the research done with high-achieving second language learners, "little attention has been paid to the language learning technicalities of polyglots, such as their motivation, strategies, or their beliefs." (p. 305)

Erard makes the case that hyperpolyglots do not, in fact, have different strategies or techniques, but, rather, they approach the use of time more effectively and are more dogged. In reference to Mezzofanti's apparent use of flashcards, Erard makes his central point:

> One reason that Mezzofanti and people like him are so fascinating is that they seem to have leapfrogged the banality of method. They don't learn languages; they 'pick them up.' They don't sit down and read lists of words; they absorb them. We hope that the methods are magic, and that if we adopt those methods too, we might achieve great things. The truth is, Mezzofanti and others haven't escaped the banality of methods at all; they make the banality more productive. Their minds *enjoy* the banality. (Erard, 2012, p. 269)

This reflects the separate aspects being investigated in this study. What is a typical approach for a hyperpolyglot to learn an additional language? Is 'practice' the 'deliberate practice' of expertise and expert behavior? Is the concentration of a hyperpolyglot reflective of a flow state? What is the hyperpolyglot mindset to language learning? Do hyperpolyglots display grit to get through difficult learning situations or to find opportunities to practice? If these qualities do work together synergistically it is with hyperpolyglots that this will be most obvious. Hyperpolyglots are included as subjects in this study because they could be attractor states in a complex system–the result of the confluence of factors such as SRL, deliberate practice, flow, mindset, and grit.

2.3 Self-Regulated Learning

Self-regulated learning (SRL) is a construct which is used to explain success in, typically, academic endeavors. As a theory of learning and skills development SRL is robust in that it provides "significant predictions of students' academic outcomes" (Zimmerman, 2008, p. 166). SRL is a learner-centered construct which deals with how learners react to their situations. It relates to

how success is predominantly attributed to forces which are controlled or strongly influenced by the learner.

After a short background, this section will look at SRL concepts relevant to this research. First, definitions are given with an explanation of Zimmerman's (2002) model of SRL; next, a short overview of SRL in SLA, inclusive of learner autonomy and related ideas, is covered; finally, SRL's inclusion in this research is explained.

2.3.1 Background

This section gives a very brief history of SRL. This is followed by some of the different ways of conceptualizing SRL: cognitive strategies, the social-cognitive perspective, the cognitive-behavioral view, and the socio-cultural view are briefly described.

The study of self-regulatory processes began in the 1960s, coming from various related areas of research including those which focused on metacognition/cognition, social and motivational characteristics, cognitive-behavioral characteristics, and developmental traits. These merged into the field of self-regulation in the 1980s (Zimmerman & Schunk, 2011). This can be a hindrance when trying to review the field because "The problem with a complex construct such as self-regulated learning (SRL) is that it is positioned at the junction of many research fields, each with its own history" (Boekaerts, 1999, p. 447). The different fields which combined to create SRL each has its own definitions and approaches to research, which means that similar ideas and considerations have been conceptualized in different ways (Zimmerman, 2008).

Zimmerman and Schunk (2011) relate that interest in SRL in the 1970s came from a consideration of cognitive strategies used by students in specific learning situations. The subsequent observation that these strategies did not

seem to spontaneously transfer to new situations led to the question of whether the strategies *could* be transferred. It was found that they could. This process involved teaching such things as how to set goals, using imagery, and self-instruction (Zimmerman, 2008) and is described as cognitive/metacognitive in the literature.

The second area of research dealing with SRL focuses on the social aspects of learning and is the social-cognitive perspective (Zimmerman, 2000), which is attributed to Alfred Bandura. Bandura believed that SRL is influenced by various people including peers and parents in the form of standards upon which to model behavior (Bandura, 1969). The resultant effects of these influences were apparent in feelings of self-efficacy and the efficacy of learning strategies. In Bandura's framework (1984) SRL is a tripartite model consisting of a recursive relationship between self-observation, self-judgment, and self-reaction. Self-observation refers to learners scrutinizing their own actions; self-judgment refers to learners evaluating the effect of their actions in relation to a standard; and self-reaction relates to how insights from the previous are used (Bandura, 1986). This model is used in this research to analyze interview data.

The third area of SRL is cognitive-behavioral. This consideration of learning deals with how behavioral changes can influence cognition and with how behavior can influence self-control. Largely, it relates to how learners self-instruct, self-reward, and self-punish (Zimmerman & Schunk, 2011). That is, SRL involves teaching oneself how to learn as well as controlling one's own rewards and punishments. This process is directed towards controlling personally defined outcomes.

According to Zimmerman and Schunk (2011) the fourth area of historic research deals with developmental processes and is an alternative

conceptualization of socio-cultural behavior. Unlike the social-cognitive perspective, the socio-cultural perspective draws on Vygotsky's zone of proximal development (ZPD). It entails, therefore, support from others in scaffolding and leads to SRL with differing degrees of success through internalization of ideas and skills.

A consideration of the above conceptual areas reveals that there is not a situation of mutual exclusivity. That is, cognitive strategies dealing with learning to learn have clear parallels in both the social-cognitive perspective, in which the learner's environment provides models of behavior, and the socio-cultural perspective, in which the ZPD describes a situation in which learners can become self-regulated. The cognitive-behavioral model is not exclusive of the other three in that actions taken by learners regarding regulating behavior, described by Zimmerman and Schunk (2011) as antecedents, consequences, and covert reactions, can be seen as facilitative to improving strategy effectiveness, manipulating the different components of the recursive relationship in Bandura's model, and learning how to situate oneself for learning as with the Vygotskian concept.

2.3.2 Definitions and Description

Unlike many other concepts in education there is a great deal of accord in the definition of SRL. In a 1986 symposium, it was agreed that the definition of SRL is "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman, 2008, p. 167). Definitions of SRL, then, tend to be different less in terms of large-scale components but rather in the ways in which various aspects are emphasized. In reference to these differences, Zimmerman suggests a core set of ideas.

First, Zimmerman (1990) says that conceptions of SRL share the idea that self-regulated learners are not distinct because they use self-regulation processes. According to Zimmerman, all learners use self-regulatory processes to some degree. Rather, successful self-regulated learners are distinct because they are aware of the effectiveness of the strategies they use and are systematic in using these strategies for motivational as well as behavioral purposes. A self-regulated learner would, therefore, have the wherewithal to question the effectiveness of an approach to, for example, learning vocabulary, while a less self-regulated learner would not have the same considerations but rather continue to learn vocabulary using the same methods no matter if these methods lack effectiveness.

Second, Zimmerman (1990) states that most definitions share the idea that self-regulated learners use feedback to enhance learning. Zimmerman describes this as a self-oriented process in which learners scrutinize and evaluate their learning with either negative or positive feedback to make covert changes in such areas as self-esteem and self-concept, and/or overt changes in areas of behavior. Using the previous example of vocabulary acquisition, a self-regulated learner would, upon identifying a problem in learning vocabulary, engage in self-encouragement and/or make changes to find a better approach.

Third, Zimmerman (1990) says that definitions of self-regulated learning contain rationalization of strategy use. Some definitions, Zimmerman suggests, are based on a simple value-multiplied-by-expectancy calculation in which learners consider outcomes in terms of effort. If an outcome is deemed not being worth much effort the learner may choose not to self-regulate. Rewards, according to some definitions, are external in that that they relate to approval from others or to some type of material benefit, while other definitions deal with

more internal benefits such as self-esteem. Zimmerman states that the reality of how learners rationalize is likely on the continuum between these two points.

Zimmerman (1990) also states that self-regulation requires a combination of motivation and learning, and that these concepts cannot be independent of one another. That is, there is a recursive relationship in which motivation will lead to successful learning which will, in turn, lead to more motivation. This leads to more proactivity.

Hadwin, Järvelä, and Miller (2011) define SRL from a social-cognitive perspective. In their definition, the situation influences learners in terms of how self-regulated learners "adopt, develop, and refine strategies, monitor, evaluate, set goals, plan, and adopt and change belief processes" (p. 68) and this results in "changes in knowledge, beliefs, and strategies" (p. 68) which can be transferred to new situations. Although there is not a 1:1 relationship with this definition and Zimmerman's core ideas, there is no conflict. There is, however, the addition of the concept of transferability of SRL strategies into new situations.

Schunk and Ertmer (2000) echo other descriptions of SRL and, as with other definitions, they focus on SRL as a process:

> Self-regulation comprises such processes as setting goals for learning, attending to and concentrating on instruction, using effective strategies to organize, code and rehearse information to be remembered, establishing a productive work environment, using resources effectively, monitoring performance, managing time effectively, seeking assistance when needed, holding positive beliefs about one's capabilities, the value of learning, the factors influencing learning, and the anticipated outcomes of actions, and experiencing pride and satisfaction with one's efforts. (p. 631)

This definition, as with the others, sees the student as the originator of the actions which lead to effective learning.

Using the understanding of SRL as a process, Zimmerman (2002) provides a model of "three cyclical phases" (p. 67). This tripartite view of SRL includes a forethought phase, a performance phase, and a self-reflection phase (Figure 2-1). Each of these phases is broken down into several different components. All these phases require the learner to be proactive or, using an explanation more directly in line with SRL, these phases require learners to take responsibility for their own learning and processes, evaluating and modifying different aspects of their skills development as necessary.

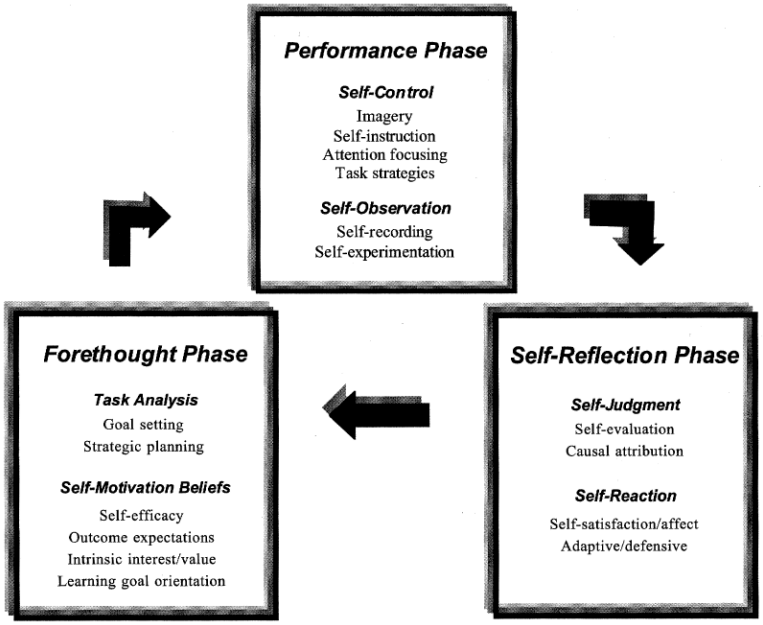

Figure 2-1 - Phases and Subprocesses of Self-Regulation. From B.J. Zimmerman (2002), "Becoming a self-regulated learner: An overview." Theory into Practice, 41(2), 64–70

Although they might seem divorced from the classroom, the parts of this process are beneficial to the language learning educational environment: "research shows that self-regulatory processes are teachable and can lead to increases in students' motivation and achievement" (Zimmerman, 2002, p. 69). Unfortunately, Zimmerman continues, "few teachers effectively prepare students to learn on their own" (p. 69).

Zimmerman (2008) says that SRL is concerned with how learners proactively respond to learning. That is, the focus is on what the learner does rather than what is done to the learner:

> Self-regulated learning and performance refers to the processes whereby learners personally activate and sustain cognitions, affects, and behaviors that are systemically oriented toward the attainment of personal goals. (Zimmerman & Schunk, 2011, p. 1)

This does not negate the effect of outside influences but, rather, defines how learners react to them. This simple description of the field of SRL is powerful for two reasons: it gives insight through the description of successful learners (successful learners are typically self-regulated), and it also makes a testable prediction that SRL, if used by students, can lead to higher achievement.

Although self-regulation is not an absolute requirement to be a high performing student the tendency is clear. Students who are less successful tend to lack self-regulation ability (Ablard & Lipschultz, 1998). Ley and Young (1998), for example, found that students who were admitted to university as "developmental students" (students who lacked some skills required for successful learning in university) as opposed to "regular" students, displayed less self-regulating behavior.

2.3.3 SRL in SLA

Consideration of SRL in SLA has been lacking. While there is certainly an awareness of SRL in SLA literature, it is referenced in many papers and a few scholars directly draw on it, there has otherwise not been a great deal of attention dedicated to it, although there has been interest in SLA to draw more on this construct (e.g., Dörnyei, 2005; Tseng, Dörnyei and Schmitt, 2006; Murray, 2014). SLA developed its own lines of related research—learner autonomy (LA), self-directed learning (SDL), and the intertwined concept of learner strategies (LS)—all of which have links with one another as well as points of convergence with SRL. The clarity of these links, however, is muddled

by the non-Newtonian fluid definitions of all the terms—they congeal when pushed but spread out when not being attended to.

Oxford (1990), in mentioning autonomy and SRL, notes that there are some places where autonomy refers to SRL and other places where SRL draws on the definition of autonomy; Hurd (2005) states that SRL and autonomy are frequently used synonymously in the literature; Hall (2011) sums up the quagmire: “autonomy is a multi-faceted concept!” (p. 154) and gives details of different aspects of definitions, pointing out that there are definitions in which technical aspects dealing with teaching learners how to learn; psychological aspects which deal with cognition and attitudes; and political aspects which deal with empowerment. Disentangling the definitions is not possible as any definition has as good a claim as any other. The best that can be done is to examine some of the aspects to see how they relate to SRL.

In discussing the definitions of autonomy, Aoki (1998) clearly states three main problems:

1) Researchers use the term with different definitions.
2) Some researchers do not define the term explicitly.
3) There are several other technical terms which are used sometimes interchangeably with autonomy and refer to a distinctly different concept at other times. (p. 129)

In discussing Holec’s (1981) definition, Aoki (1998) points out that for Holec autonomy is a capacity for action while self-directed learning refers to the actions taken should a learner choose to act on his/her autonomous capacity. On the other side, however, are Dickinson’s (1987) definitions, which define autonomy as responsibility for action, “which can be said to be an identical concept to self-direction in Holec” (p. 132); self-direction is an acceptance of responsibility for learning although not necessarily acting on that responsibility.

Aoki also points out that Wenden (1991) uses autonomy as inclusive of 'learning how to learn,' unlike Holec's conception in which this is not a factor. So, for Wenden, autonomy is not only responsibility and action, it also incorporates strategies.

Aoki (1998) also discusses Little's (1991) definition, which is perhaps the clearest in terms of seeing the relationship with SRL:

> a capacity—for detachment, critical reflection, decision-making, and independent action. It presupposes, but also entails, that the learner will develop a particular kind of psychological relation to the process and content of his learning. The capacity for autonomy will be displayed both in the way the learner learns and in the way he or she transfers what has been learned to wider contexts. (Little, 1991, p. 4)

The conceptual parallels to SRL in this definition are clear as it includes all the aspects of the aforementioned definition of SRL: "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman, 2008, p. 167).

Unfortunately, there are other definitions which move from overall definitional links and into using definitions which are narrower. For example, Hurd's (2005) definition more specifically relates to Zimmerman's performance phase (2008), meaning that in her framework LA can be seen as synonymous with part of SRL rather than the entire construct (or at least synonymous with a portion of Zimmerman's SRL construct).

Other definitions of LA vary around a theme in SLA literature. Littlewood (1996), for example, gives a definition of autonomy in which it is the capacity individuals have for directing their own actions. In his definition, this capacity is divided into two parts: ability and willingness, both of which can be sub-divided into, respectively, knowledge and skills, and motivation and confidence. In this definition there are clear parallels to SRL as self-regulated learners, to be

effective, need these attributes. What Littlewood's definition is missing is actual behavior.

While LA and SRL are related, they are rarely examined in terms of their similarities. Murray (2014) acknowledges this lack of comparison: "What is surprising, given their shared interests, is the lack of attempts to examine how the two might be related, how they differ, and how research in one area might inform work in the other" (p. 320). He lays out a comparison of the two concepts (using a broad definition of autonomy) and concludes that while there are differences the two are closely related in the areas of active engagement, goal-directed behavior, metacognitive skills, intrinsic motivation, and learner characteristics. He states that both autonomy and self-regulation can be seen as characteristics, with autonomy having the added facet of being integrated into the learning environment (students being given some input in how classes are run). Murray does, however, note that student control is a part of proactive autonomy, while in reactive autonomy students react to the dictates of teachers. Reactive autonomy can be seen as closer to SRL as the research in SRL typically dwells on learners making choices and reacting/adapting to their learning environments.

Lewis and Vialleton (2011) compare the frameworks of autonomy and SRL and emphasize that traditional views of LA consider autonomy to be a capacity which affects actions but is not itself an action. More importantly, they say that while LA has its roots in critical theory, from which it can be inferred that autonomy is possibly viewed as emancipation from the formal strictures of education, SRL has its roots in educational psychology. It is from this that they describe a key difference: "It [SRL] differs from the latter [LA] in being applicable

to a range of disciplines, rather than simply language learning" (p. 207). Through this lens LA can be seen as a learner's critical awareness of the learning situation and the actions which come from this awareness. SRL, on the other hand, does not use the term 'critical' in the post-Marxist sense but rather in its more typical adjective form to modify things such as self-evaluation or self-reflection.

There is some evidence that Dörnyei equates SRL directly with LA in the critical sense, or at least that there was a point in his career in which he did. In his 2001 work, in a manner which shows the 'definitional fuzziness' he laments on in a later paper, he writes: "it [autonomy] is also discussed under the label 'self-regulation'" (2001, p. 102). It is difficult to imagine that Dörnyei is using a definition of SRL which is consistent with the definition he uses in his later writing (see below) as his description of autonomy indicates that he is discussing learner contribution and influence on the learning situation, which is in line with the critical conception of LA.

In a later work Dörnyei and Skehan (2003) give a different outline of the bounds of SRL. In their discussion, the authors say that the area of learner strategies, having been problematic, is being replaced by SRL, which they envision as a process. SRL "could also be perceived as a multidimensional construct, including cognitive, metacognitive, motivational, behavioural, and environmental processes that learners can use to enhance academic achievement" (pp. 611-612). This is the point where definitional overlap is accepted and the divergence pushed aside to bring SLA's LS and LA views into the purview of SRL.

Tseng, Dörnyei and Schmitt (2006) make the case that learner strategies be equated with self-regulatory mechanisms, and in doing so envision these strategies/mechanisms as 'micro-processes.' They also, while not drawing on the complexity framework explicitly, have a vision of a complex system and this is clear when they describe processes as sub-systems within "the broader concept of self-regulation" (p. 81). Tseng et al. (2006) believe that the SRL framework is less problematic than the learning strategies framework of SLA because, in particular, SRL lends itself to psychometric testing. This is, in part, due to the aforementioned 'definitional fuzziness' of strategies which are both behavioural and cognitive.

The most ambitious effort to adopt SRL in SLA comes from Rebecca Oxford (Oxford, 2013). In acknowledging the relationship between SRL and LA, Oxford brings them together, heavily relying on the behavioral aspects (learner strategies) of LA: S^2R, or Strategic Self-Regulation. Oxford sees SRL as the larger system within which LA and LS operate, and her S^2R description is intended to incorporate these concepts into a single definition in SLA.

Although she does not say it directly, Oxford seems to view S^2R as a CAS. First, there is the aforementioned subsuming of LA and LS as subsystems with larger constructs, and, in referencing Wolters, Pintrich, and Karabenick (2003), she says that these constructs are non-linear and not necessarily hierarchical. Further, Oxford describes her S^2R model as encompassing a complex "web of beliefs, motional associations, attitudes, motivations, sociocultural relationships, personal interactions, and power dynamics" (2013, p. 40).

2.3.4 Inclusion in this study and possible interrelationships

SRL is included in this research due to its broad explanatory power and is envisioned as a system within which most other fields are subsystems. This is because the agent is said to be self-regulated while all other factors deal with the particulars of self-regulation. To use the hub conceptualization, it is possible that SRL is a primary hub with many connections.

SRL matches other areas of research closely. Self-regulated learners activate cognitions taking personal responsibility for actions; they sustain cognition, affects, and behaviors, indicating control and awareness of thoughts, feelings, and actions; and they are 'systematically oriented toward the attainment of personal goals,' which shows an awareness of effectiveness and efficacy as based on progress towards predetermined objectives. At the core, then, self-regulated learners are self-aware (growth mindset, flow, deliberate practice), self-starting (grit, flow), self-motivating (mindset, grit, flow, deliberate practice), self-driven (growth mindset, grit, flow, deliberate practice), and self-critical (growth mindset, flow, deliberate practice) (see table 2-2).

		Mindset	Grit	Flow	Deliberate Practice
SRL factors	Self-aware	X		X	X
	Self-starting		X	X	
	Self-motivating	X	X	X	X
	Self-driven	X	X	x	X
	Self-critical	X		X	X

Table 2-2 – Possible relationships between SRL and other systems

SRL research in education is an area of research which usually relates to how students, in the academic sense of the word, react to and negotiate formal learning situations. It does not delve into autodidacts which might be an issue when considering hyperpolyglots because hyperpolyglots are typically autodidactic (Erard, 2012). However, while hyperpolyglots characteristically

learn outside of formal academic situations it is likely that they will display qualities of self-regulated learners.

2.4 Expertise and Expert Performance

Expertise and expert performance is a field which frames and explains high levels of performance in all arenas of human endeavor. Research in this field is centered on skills development through extensive time spent engaging in deliberate practice. Objections raised against expertise and expert performance generally accept that practice is a necessary component of high achievement and question only its relative importance vis-à-vis 'innate' factors such as genetics, talent, or IQ, stressing that time spent practicing is a necessary but not a sufficient condition for the attainment of high levels of skill (Ericsson & Lehmann, 1996). The views of the role of talent are wide, with some seeing the amount of talent as a limit on development and others seeing it as an initial condition which must be met to develop to a high level (Ackerman, 2014; Detterman, 2014).

In the past, an extreme view of the role of nature was emphasized by such people as Sir Francis Galton (1892), and from there the pendulum swung in the other direction with B. F. Skinner (1976) and behaviorism. In more recent times the view is more favorable of the middle ground and it is considered that there is a situation in which genes interact with the environment, which can be described using G x E (Kaufman, 2013).

Ericsson, the most well-known and prolific of the expertise and expert performance researchers (e.g., 2007; 2008; 2012; 2014; 2016), is habitually charged with being on the environmental extreme of the nature/nurture spectrum (Detterman, 2014; Grabner, 2014; Simonton, 2014). Ericsson's

aversion to the nature arguments are seen in his emphasis that the common concept of talent is not supported and can be detrimental:

> The commonly held but empirically unsupported notion that some uniquely 'talented' individuals can attain superior performance in a given domain without much practice appears to be a destructive myth that could discourage people from investing the necessary efforts to reach expert levels of performance. (Ericsson & Ward, 2007, p. 349).

Popular explanations are possibly not only inaccurate, according to Ericsson they are potentially harmful.

2.4.1 Background

The modern field of expertise and expert performance arose from a study of human short-term memory. Miller's Law states that human working memory is seven digits, plus or minus two (Miller, 1956). Chase and Ericsson (1981), however, discovered that working memory could be substantially increased, and their first subject, Steve Faloon (referred to as SF in the literature), learned to remember over 80 digits. This led to the hypothesis that limits are possibly neither innate nor insurmountable and that performance can be improved through appropriate effort.

Ericsson began to look at experts to determine how they had overcome apparent limits. His resultant framework of expertise and expert performance shows that talent, if it exists at all, is not an adequate explanation for high performance. Indeed, Ericsson dismisses predetermined limits to ultimate achievement:

> Learning is no longer just a way for fulfilling some genetic destiny; it becomes a way of taking control of your destiny and shaping your potential in ways that you choose. (Ericsson & Pool, 2016, p. 48)

In the expertise and expert performance framework exceptional performance is the result of development and growth rather than the products of genetic

endowment (except for genes related to physical attributes such as size in fields where size matters, such as in sports).

There has been, in recent years, an academic dustup between expertise and expert performance and other fields which concern themselves with talent and giftedness. As a means of ordering the conflict, *Intelligence* published a special issue in 2014 to ostensibly give a platform for both sides, resulting in an issue which pits Ericsson against a number of academics. Typically, the talent camp states that practice is a necessary component for high levels of skills and performance but not a sufficient one (De Bruin, Kok, Leppink, & Camp, 2014; Hambrick et al., 2014). The expertise side of the argument usually concedes that talent could exist, but it is neither a necessary condition for explaining high levels of skill nor has sufficient evidence for its existence been put forward (Ericsson, Krampe, & Tesch-Römer, 1993).

2.4.2 Definitions and Description

The definition of ‘expert’ is varied. Colloquially it is used to refer to a person who is seen to have more knowledge or ability than others—a relative scale based on local appraisal. It is also often used to refer to someone who has extensive experience in a domain. Both of these are problematic. While the relativity of the first is not necessarily wrong, it runs the danger of being too specific to a local group. Being a ‘big fish in a little pond’ does not mean that there are not much bigger fish in other ponds. Extensive experience in a domain being used to evaluate expertise is more problematic because mere time spent on a task does not strongly correlate with a constant trajectory of improvement. For example, all of us engage in regular activities, sometimes daily, but do not improve to a high level, such as with typing speed or using Microsoft Word. Worse, time spent in a field can lead to reduced performance if the participants

are not being challenged, as with physicians (Choudhry, Fletcher & Soumerai, 2005).

The clearest definition of expert comes from Ericsson (2008). Ericsson suggests that social recognition of people as experts be dropped in favor of a more objective measure: "reproducibly *superior* performance in a given domain" (p. 989). This definition is partly in reaction to situations in which people labelled experts are not objectively superior to their peers, such as amongst many financial 'experts' where research has found that the performance of those labeled 'experts' is not better than that of non-experts (Bodnaruk & Simonov, 2014). It also helps the ease of measure in many cases where expertise can be made objective, as is the case with expert chess players where the rating system is clear.

It is not easy to apply this definition in all areas. The quality of an artist's painting skill, for example, is subjective, and some works might be considered excellent when they should not be, leading to labeling artists such as Pierre Brassau an expert—a label which was likely dropped after it was revealed that Pierre Brassau was a chimpanzee (*Zoo Story*, 1964). Also, the level of expertise of a subject can be judged in relation to a large community of people who interact and are aware of one another, such as computer game players, but not for fields such as welding, where there is no evaluation method which deals with the quality of welds beyond those which are meant to assure that the work is to a minimum standard (there are welding competitions but these do not give anything but a relative ranking for those involved in small-scale competitions).

The definition of deliberate practice has a hint of clarity. Ericsson and Pool (2016) divide practice into four types: naïve practice, purposeful practice, proto-deliberate practice, and deliberate practice. Naïve practice is merely going through the motions and will not lead to high levels of skill development. Purposeful practice, which can lead to high levels of performance before, typically, hitting a wall, is practice which is focused on goals, both proximal and distal, uses feedback, and puts a person outside of their comfort zone. Proto-deliberate practice relates to the practice in areas in which there are not established measures of success nor established methods of practice. For example, piano players can draw on a wealth of instructional materials or be taught by myriads of tutors with different approaches, using established methods which have appeared, over time, to be effective; an endeavor such as fishing, however, tends not to have a formal learning framework and improving is a matter of both practice and finding other 'experts' to get advice and ideas from.

Deliberate practice, described by Ericsson as 'the gold standard,' is practice which has "been specifically designed to improve performance" (Ericsson, 2009, p. 413). It has the components of purposeful practice, goals, feedback, pushing outside of one's comfort zone, and typically has the addition of a teacher or a coach—someone who can help to highlight problematic areas and areas for improvement, as well as to design practice to overcome issues in these areas.

In SLA the concept of expertise is muddied. It is tempting to use language test scores such as the Test of English as a Foreign Language (TOEFL) or the Test of English for International Communication (TOEIC), but these scores can be inaccurate due to the negative washback resulting from studying towards a

score rather than towards mastery of the language, creating a situation in which test scores might not be indicative of second language ability but, rather, of the ability to take tests (Choi, 2008). Other issues which arise are areas of proficiency: is an expert a person who learns a single second language to a high level of proficiency? A person who learns multiple languages to a high level of ability? A person who learns many languages to a level of communicative competence? A person who can learn a language to a level of communicative competence quickly? A person who eliminates all traces of a foreign accent? A person who can discuss particle physics with colleagues in a second language? It is quite possible to consider that each of these could have its own specific expert language learning profile. Ericsson (2016) makes the point that many fields have people filling various niches. For example, in academics there are tutors, teachers, professors, classroom designers, educational technologists, textbook editors, etc. Considering this, is it possible to say that someone is a definitive language learning expert?

While a ‘definitive’ expert might not exist, it is possible to look at different types of high performance and to choose a particular type of expert. As mentioned earlier, for the purposes of this research, hyperpolyglots are the experts being considered—with people who can communicate in over six languages it is difficult to not consider them experts. Hyperpolyglots, rather than showing expertise in learning a specific second language, would be more likely to show generalizable learning traits which can relate to learning various languages. For example, a person who loves anime might have a relatively easy time learning Japanese, be a Japanese ‘expert learner,’ because of intrinsic interest, while that same person, if studying a language from the Khoisan group, might be at a loss due to the lack of an anime equivalent in the

cultures of that group. Hyperpolyglots, on the other hand, will be more likely to have a skillset which will allow them to learn a Khoisan language.

2.4.3 Inclusion in this study and possible interrelationships

Expertise and expert performance is included in this research to consider its viability in explaining high levels of success in second language acquisition as a stand-alone concept and, more importantly, to examine its relative importance in terms of its interaction with other factors in the complex system of second language acquisition. It is a system that will likely be present amongst subjects who have achieved a high level in one of the various notions of success with second languages and so can be envisioned as a system high on the hierarchy for successful learners and possibly absent (in terms of hours of deliberate practice) for those who are less successful. The field should provide a frame for the number of quality hours experts spend practicing, which could help to illuminate differences between expert language learners and less successful language learners.

The possible interrelationships with other lines of research and expertise and expert performance are numerous. First, the number of hours required to become an expert are high, indicating that learners who approach expert levels are likely to have had the promise of success to maintain the necessary motivation over the long term, and this belief in success could be related to a growth mindset; long-term effort towards a goal could be related to grit; the quality of practice, the difference between deliberate and ordinary practice, could be related to flow; SRL would seem to be a facilitating component of at least purposeful practice and possibly deliberate practice.

2.5 Flow

Flow is situated within the field of positive psychology and is described as a state in which a person is intensely focused on an activity or task using all, or nearly all, mental resources. A flow state is not uncommon, and most people are likely to have experienced it using a more common phrase such as ‘being in the zone’ as a description. Flow is characterized by a loss of environmental awareness, a feeling of control, temporal distortion, and a sense of reward coming from the activity itself (Csíkszentmihályi, 2014a). It is a useful construct for explaining and framing motivation, time on task, concentration, and practice (among others). “The concept of flow has been found useful by psychologists who study happiness, life satisfaction, and intrinsic motivation” (Csíkszentmihályi, 1991, p.5).

2.5.1 Background

Mihaly Csíkszentmihályi is the originator and most influential researcher in the field of flow. The discipline had its genesis when Csíkszentmihályi noted the single-minded concentration and devotion to tasks being shown by subjects when involved in acts of creativity, as well the similarities of description when subjects discussed their experiences. Research in the 1980s and 1990s refined the concept of flow and subsequent description used terms such as ‘optimal experience’ (Nakamura & Csikszentmihalyi, 2009).

2.5.2 Definitions and Description

The definition of flow is stable with researchers pointing out that there has been little change since the definition given by Csíkszentmihályi and Csíkszentmihályi in the seminal 1975 work. This lack of change is attributed to different factors, including the fact that nothing appreciably changed since the

original work and that the definition is not so rigid as to exclude additional elements (Engeser & Schiepe-Tiska, 2012).

Csíkszentmihályi and Csíkszentmihályi (1975) defined flow as consisting of six components: a coalescence of action and awareness, intense concentration on a specific stimulus, a loss of self-consciousness and self-awareness, a feeling of being in control of the situation and its demands, clarity of how to act and react, and autotelic behavior in which the activity is a goal or reward in itself. The coalescence of action and awareness describes a situation in which a person is not separate from an activity. That is, awareness and action merge so that a person in a flow state is not merely doing something but is an extension of the something that is being done. The intense concentration means that other stimuli are shut off. This feeling is clear when considered as a situation in which a person is so engrossed in an activity, whether it be reading a book or watching a movie, that even saying the person's name multiple times gets no reaction. Loss of self-consciousness and self-awareness is related to the ego. It is akin to a state of awe, euphoria, or transcendence. It could be described as a state in which a person has stepped outside of the mundane and into the, figuratively speaking, spiritual realm. Control is descriptive of the feeling of power which arises from a flow state. That is, during a flow state a person feels the power of an expert or virtuoso who is directing the action rather than being directed by it. Clarity of action and reaction is descriptive of the actions which are undertaken in an activity—there is no question as to what reaction is needed to meet an action, and which action is needed to meet a reaction. The steps of the sequence are seemingly clear and logical. Finally, there is the autotelic aspect of a flow state. External rewards or validations are not necessary because the task is its own reward—it is self-motivational.

Much of the definition of flow relates to the limits that humans have on their attention. Csíkszentmihályi, through some creative mathematics, estimates the limit of human attention to be about 120 bits of information being processed by the brain in one second (2014b). This amount of processing requires the full use of the brain, crowding out all other thoughts and considerations so that complete focus is being devoted to a single task. Csíkszentmihályi contends that to achieve this level of processing and attention, to achieve flow, some criteria must be satisfied.

To reach flow the ability level of an individual must match the difficulty level of a task. If a task is too easy flow will not be reached because the mind will wander. If the difficulty of the task is too high stress will affect concentration and the person will not be able to reach or maintain a flow state. In terms of the difficulty of the task there must be an attempt directed to overcoming an ability gap. That is, a flow state is achieved through an effort to achieve a level that is higher than an individual's present skill level, and that attempt must have some direction or framework in order for it to have the promise of success (Schüler, 2007).

A description of flow helps to make clear a possible link to deliberate practice. Csíkszentmihályi explains that "[w]hen goals are clear, feedback relevant, and challenges and skills are in balance, attention becomes ordered and fully invested" (Csíkszentmihályi, 1997, p. 31). Compare this to Ericsson and Lehman's description of deliberate practice in which they state: "to receive maximal benefit from feedback, individuals have to monitor their training with full concentration," (Ericsson & Lehman, 1996, p. 279) as well as a situation when people are:

> 1) given a task with a well-defined goal, 2) motivated to improve, 3) provided with feedback, and 4) provided with ample opportunities for repetition and gradual refinements of their performance. Deliberate efforts to improve one's performance beyond its current level demands full concentration and often requires problem-solving and better methods of performing the tasks. (Ericsson, 2008, p. 991)

Motivation and feedback are in both descriptions, with Csíkszentmihályi stating that this creates complete attention, while Ericsson says that both purposeful and deliberate practice require complete attention.

While the relationship between flow and deliberate practice may seem clear, there is some contention. Ericsson once stated that he does not believe that flow is related to deliberate practice:

> It is clear that skilled individuals [experts] can sometimes experience highly enjoyable states … during their performance. These states are, however, incompatible with deliberate practice, in which individuals engage in a (typically planned) training activity aimed at reaching a level just beyond the currently attainable level of performance by engaging in full concentration, analysis after feedback, and repetitions with refinement. (Ericsson, 2007, p. 349)

It could be argued that Ericsson is relying on an incorrect or too narrow a definition of flow, as evidenced by his use of 'enjoyable states.' Csíkszentmihályi (1997) explains that enjoyment can be the *result* of flow, but this is only apparent *after* a flow experience because during flow the mind is too focused to experience anything but the task itself; also, flow does not necessarily lead to enjoyment but to various feelings such as satisfaction. Ericsson's description of deliberate practice as requiring full concentration, analysis, and refinement is key. While it could be true that not all flow experiences are deliberate practice, it seems possible that along the continuum of naïve practice to deliberate practice, from little effectiveness to maximum effectiveness, the more effective end of the spectrum would be a situation in which an individual has met at least some of the requirements to be in a flow

state. That is, when considering naïve, purposeful, proto-deliberate and deliberate practice, flow would likely be minimal or absent in naïve practice, while it would be increasingly likely to be present on the deliberate practice end of the spectrum.

Despite his initial rejection, Ericsson later softened his stance in terms of the relationship between flow and deliberate practice. While falling short of describing flow as an aspect of deliberate practice, Ericsson compared the effect of the quest for excellence as compatible with the concept of flow. That is, he obliquely accepts that there could be a relationship between flow and deliberate practice although he does not flesh out the idea (Ericsson & Pool, 2016).

So, while possibly related, flow and deliberate practice are not the same. Primarily, Csíkszentmihályi's research concerns itself with individuals' actions, dealing very much with individual psychology (although he does not dismiss teachers and coaches). Ericsson and Lehman state that deliberate practice is, "individualized training activities especially designed by a coach or teacher to improve specific aspects of an individual's performance through repetition and successive refinement" (1996, pp. 278-279). Flow could be present in both purposeful and deliberate practice, and while it helps to make clear where levels of concentration are appropriate, separating naïve practice from more effective practice, it does not work as well to separate proto-deliberate from deliberate practice. Nevertheless, flow is conceived of in this study as possibly being recursively related to deliberate practice and consistent flow states could also help to explain some of the difference between the time required by different people to achieve levels of proficiency in the expertise and expert behavior framework.

2.5.3 Inclusion in this study and possible interrelationships

Flow can be used to add explanatory power to the complex system of second language acquisition in multiple areas. As a stand-alone construct, flow relates to motivation, practice, and attitude. First, if envisioned as a nested system of expertise and expert performance and/or SRL, flow helps to define learning tasks, approaches to those tasks, and the feelings of efficacy as they relate to an agent engaging in those tasks. Flow could relate to other factors such as mindset and, in addition to being a subsystem of the above, it could also be a stable attractor state around which, if pushed, expertise and expert performance, SRL, and mindset settle.

As it relates to the present research, it was hypothesized that flow would be increasingly obvious towards the expert end of the second language acquisition spectrum, being most strongly manifested in hyperpolyglots. This is primarily due to the amount of time required to learn multiple languages—it is somewhat easy to credit success in a single second language to self-development, résumé padding, or a national education system, but success in multiple languages would require much stronger motivation such as the feeling of flow.

The relationship to deliberate practice should also be apparent through the research. It is not certain that expert language learners do anything differently than less successful second-language learners in terms of techniques. After all, even the “50 or 60 language” hyperpolyglot Mezzofanti (1911 Encyclopedia Britannica, 2015) used flash cards (Erard, 2012). One difference is likely the quality of the engagement in the activities in terms of language learners’ focus. That is, an unsuccessful learner will more likely be engaging in naïve practice

while a hyperpolyglot is more likely to be engaging in purposeful or deliberate practice, which could possibly be identified by time spent in a flow state.

2.6 Mindset

Mindset is an area of psychology which deals with how individuals interpret and react to success and failure in their endeavors. Mindset relates to implicit theories of intelligence along a continuum from entity (intelligence is innate and unchangeable) to incremental (intelligence can be developed) and how these affect performance and attainment (Blackwell, Trzesniewski, & Dweck, 2007). Primarily, mindset helps to explain the impetus behind the learning choices which people make and how these choices either increase the likelihood of continued improvement or, conversely, increase the chance of giving up.

2.6.1 Background

Mindset is related to motivation, achievement, and various subfields such as learned helplessness—it is a recursive system which is affected by and affects all of these. The main researcher in the field, Carol S. Dweck, began her research looking at some of these fields separately, and in the 2000s packaged them under the ‘mindset’ label. An incremental view of development and learning, a view in which achievement is seen as the result of effort, is called a growth mindset, and an entity view of development and learning, where achievement is seen as the result of innate factors, is called a fixed mindset (Dweck, 2006). Fixed and growth mindsets relate to the personal schemata through which individuals view the value of their efforts and the subsequent effects on effort and achievement.

A growth mindset is a mindset in which a person sees skills development as the result of effort, and not determined by innate intelligence. Typically, a

growth mindset is seen as the preferable of the two mindsets as it is more likely to lead to higher achievement in, particularly, academic settings (Yeager & Dweck, 2012). A growth mindset is not a necessary condition for the high development of skills, but it is a condition through which skills development can be facilitated. This is because mindset influences the likelihood of engaging in or continuing with actions which will lead to success. The relationship with a growth mindset and the maintenance of motivation, for example, can be seen in Haimovitz, Wormington, and Corpus (2011), where they found that students with a growth mindset (described in their study as an incremental implicit theory of intelligence) maintained or increased their levels of intrinsic motivation over an academic year and experienced greater academic achievement than their peers.

A growth mindset moves a person's appraisal of a task away from seeing blocks and hindrances to one which sees challenges and opportunities for growth. Unlike someone with a fixed mindset, a person with a growth mindset actively seeks out situations and opportunities which are challenging because of the view that it is through challenge that improvement can be achieved. Further, failure on a task is not confirmation of a lack of intelligence or talent for a person with a growth mindset, but it is, rather, feedback which indicates that more effort, or different effort, is needed to overcome a particular challenge (Miller, Högman, & Gustavsson, 2016). This can lead to a cycle where a person, in overcoming challenges, improves in their overall ability, which leads to seeking out and overcoming further challenges and continuing to progress (Grant & Dweck, 2003). Because a growth mindset is the belief that one's intelligence is malleable and can be improved with effort, that is, a person can improve ability

and skill in the area that is being focused on, the implication is that the likelihood of trying harder and persisting longer would increase.

A fixed mindset is the belief that one's intelligence is an unchanging entity and that one is either innately good or not good at something. The corollary of this belief is that effort is not needed because one is either smart or not smart; good at math or not good at math; socially adept or socially inept. The existence of this belief is related to low levels of achievement. For example, people who believe that they are good at math will possibly not put forth much effort because of the perception that smart people do not need to work at learning (Dweck, 2006). Another example in Hong, Chiu, Dweck, Lin, Wan (1999) describe students who would have benefitted from extra English classes but were seen to avoid the opportunity when such classes were offered. Their mindsets showed a clear relationship with the choices that they made–lower-level students showed a tendency towards having an entity (fixed) mindset rather than an incremental (growth) mindset.

An additional problem with a fixed mindset is quitting. Effort implies that something is difficult, and the requirement of effort is interpreted as a lack of intelligence or innate skill. Worse, if a person engages in an activity which is difficult and is not successful, a serious blow to the ego could occur: if one is intelligent, and if intelligence means that a task is easy, then accomplishing a task should not require much effort; if, however, when trying to complete a task a person meets with failure, the possibility of a lack of intelligence (or talent) arises. Rather than face the possibility of having a lack of intelligence (or talent) the ego moves towards self-preservation–better to have never tried at all than to

have tried and failed and faced the possibility that maybe one is not as smart and talented as one thinks (Dweck, 2006).

This is not to say that a fixed mindset necessarily leads to mediocrity or low levels of development, only that the tendency is there for those with fixed mindsets. If people with fixed mindsets meet with success it can fuel future efforts. For example, Grant and Dweck (2003) found that while a growth mindset better predicted results in a difficult pre-med chemistry course, a fixed mindset encouraged effort when students met with success. In complexity theory this is termed an unstable attractor—in the absence of a change in variables the state will remain steady, but any shift will cause it to move away.

In this research a growth mindset is not seen as a sufficient condition for success nor a necessary one, but, rather, a facilitating factor. That is, it is possible to become good at something without a growth mindset, and having a growth mindset makes success more likely, but a growth mindset by itself will not guarantee success nor will a fixed mindset preclude it.

2.6.2 Inclusion in this study and possible interrelationships

Although it has not been well-represented in SLA research, there have been a few studies done which show tendencies with mindsets as they relate to language learning. Mercer and Ryan (2009) found that the most important tenet of a growth mindset, that of the importance of hard work and effort, is at odds with a common assumption among learners that language acquisition can be obtained through a painless process of osmosis. That is, subjects in their research tended towards the possibly deleterious view that language learning is an effortless outcome achieved through immersion in a target-language culture

as opposed to something which is achieved through deliberate and focused effort.

Some research has also been conducted with mindset as it relates goal orientation and response to failure. Lou and Noels (2016) primed some student mindsets towards the incremental belief (growth) and others towards the entity belief (fixed). Afterwards they determined that those students who had been primed with the growth mindset had an increased likelihood of setting learning goals, and had a more positive reaction to failure, while those who had been primed towards a fixed mindset set goals more consistent with getting praise and were leerier of failure.

Mindset, then, helps to explain multiple aspects of learning. First, it helps to explain persistence, which is closely linked with grit (see the next section) as grit can be described as “the passion for stretching yourself and sticking to it, even (or especially) when it’s not going well” (Dweck, 2006, p. 7). If there is no hope that effort will lead to improvement or achievement then there is no reason to continue with a course of action, but if success is a matter of toughing it out rather than relying on the presence of innate qualities, then grittiness is an important element.

Second, it is related to motivation, a central part of SRL. It can also be envisioned as interrelated with deliberate practice in time spent on task—without some hope of success it is unlikely that the massive effort required to achieve expertise would be maintained. As a stand-alone system mindset could act as either an unstable or stable attractor, and as part of a system it possibly acts as a hub.

The challenge-seeking aspect of a growth mindset lends itself to both a flow experience and deliberate practice. Flow could be facilitated because a growth mindset tends towards matching challenge with ability. That is, in attempting challenges a person works to improve through increasingly difficult tasks. In the case of expertise and expert performance, deliberate practice necessitates striving to improve through tackling increasingly challenging tasks and it is easy to see how a growth mindset can foster this, helping to explain the quality of practice and lending clarity to the difference between naïve practice and deliberate practice.

2.7 Grit

Grit has been described as a noncognitive trait which adds predictive power to the likelihood of success in individual endeavors (Silvia, Eddington, Beaty, Nusbaum & Kwapil, 2013). Grit is related to the perseverance that individuals show towards the achievement of long-term goals. The appeal of grit is twofold: first, the degree of grit an individual has allows for relatively good predictions of an individual achieving success in an undertaking, which has made grit valuable for determining who should be given a chance to achieve in a situation in which only some of many participants can be selected; second, the possibility that people can learn to be gritty, and thereby improve the likelihood of success in their exertions, makes this field attractive to those who are interested in human development. The first point is supported by the research (Duckworth & Quinn, 2009), while the second, at the point of this writing, remains a possibility.

2.7.1 Background

Grit is not an area of inquiry with a long history, being first studied in the early part of the 21st century. The field of grit started when Angela Duckworth

noticed that some of her students were outperforming what their IQ, and 'talent' indicated they should. In her inquiry Duckworth identified grit as the quality which these outperforming students displayed and her underperforming students did not (Duckworth, 2013).

Grit is presently a trendy area of research with many studies both being conducted and having been conducted since its introduction. The first study was published in 2007 (Duckworth, Peterson, Matthews & Kelly), but a Google Scholar search brings up thousands of studies related to the topic published in the years since. Fortunately, however, there has not yet been a muddying of the definitional waters. Duckworth et al. (2007) define grit, as per the title of their seminal study, as "perseverance and passion for long-term goals" (p. 1087). This perseverance and passion manifests as enduring and steady effort maintained through periods of adversity, including disappointments which arise from limited progress and failure, as well as in navigating impediments to achievement. It is described as an attitude which envisions the way to a goal as a long-distance run rather than a sprint, and a gritty individual will persist in striving towards a goal after a point where less gritty individuals will have given up.

2.7.2 Definitions and description

Support for grit has come from many sources. Perhaps the most commonly cited support comes from several tests run by Duckworth et al. (2007) and reported in the original paper. Six studies were undertaken to consider the predictive power of grit in relation to other measures. Although not always the strongest predictor of success, grit was typically found to be more predictive than traditional measures. This predictive power was seen in instances such as

the likelihood of West Point students completing their first round of training and the likelihood of students advancing to the higher rounds of a national spelling bee. Grit also accounted for better performance in terms of grade point averages (although not at the higher end of the spectrum), as well as being related to the amount of education completed by adults. The conclusion reached in the original paper is that "grit may be as essential as talent to high accomplishment" (p. 1100)—as is common, however, there is no clear definition of 'talent' given, which means that the statement could be read as 'grit may be as essential as the confluence of a number of undetermined factors which we use the placeholder "talent" to describe.' Nevertheless, the suggestion is clear—grit is a major player in accounting for achievement.

There are some issues with grit in terms of its applicability to this inquiry in that it is perhaps not generalizable to language learning. Duckworth et al. (2007) state that "our hypothesis is that grit is essential to high achievement" (p. 1088). Using this phrasing makes grit a necessary condition, a hub, for success. The major issue, of course, is with the definition of 'success.' Duckworth et al. (2007) state that they are concerned with "objective accomplishments" which are "recognized by other people," and not success of a more "subjective value" (p. 1087). The tendency, then, is for grit research to consider similar criteria for success as those represented in IQ tests—a reflection of what the middle and upper classes of first world nations hold dear; that is, people who score well on IQ tests tend towards sociocultural groups who measure success using similar metrics—in this world it is relatively easy to determine the people who are virtuoso violin players but not so much those who are crackerjack fiddlers.

The position taken in this research is that grit will be related to some rather than all people in the CAS of language learning. It is likely not a necessary condition for hyperpolyglottery because the (hypothesized) presence of flow indicates that the activity is not burdensome. That is, for hyperpolyglots language learning is not a grind but an enjoyable pastime, and Duckworth et al.'s (2007) assertation that, "one personal quality is shared by the most prominent leaders in every field: grit," (p. 1087) is likely not true as it relates to hyperpolyglots, although it is reasonable to assume that grit would be a more common component of the CAS of those who speak one or two second languages for instrumental purposes. For example, learning English in Korea or Japan is a requirement for many jobs and to be competitive some people will push through hardships to 'make the cut.' Learning multiple languages to a high level, however, implies an attraction to learning languages, reducing the likelihood of the task being perceived as onerous and, therefore, indicating that grit is not a necessary factor.

This stance may be the opposite of how others see grit. Ivcevic and Brackett (2014), for example, say that grit "might be a better predictor of achievement in self-selected narrower goals" (p. 33). In their research, in which they compared the Big Five traits as performance predictors to grit, they found that other traits, such as Conscientiousness and Emotional Regulation Ability were better predictors. They also reveal a point central to this inquiry—all situations are different, and it could be that the situation in which their research was undertaken is not an environment in which grit would be as important a factor as it is in other areas.

Grit, according to Duckworth, relates to deliberate practice. In her study of spelling bee finalists, Duckworth (2016) set out to find if grit was linked to deliberate practice and whether grit led to increased deliberate practice. The relationship with grit and deliberate practice can be seen as a mediating condition in that an absence of grit would not preclude successful second language acquisition, but its presence would enhance it in that the learner would be getting more practice overall. It is also possible that this increased practice would tend towards deliberate practice. Duckworth (2016) says that "grit is not just about *quantity* of time devoted to interests, but also *quality* of time. Not just *more time on task,* but also *better time on task*" [italics in the original] (p. 118).

Duckworth (2016) also considers the link between deliberate practice and flow, expressing that there is an incompatibility, and this is because flow is pleasant while deliberate practice is "boring and unpleasant" (p. 129). The issue is that 'unpleasant' can be seen as a masochist's 'pleasant,' and that unpleasantness can serve as a stimulus for action. Sandler (1964) reviews various behavioral studies in which punishing stimuli, rather than leading to aversion, increase the likelihood of doing an activity. Contextualized in this way, it is easy to envision some individuals with grit as gluttons for punishment, and this gritty gluttony could facilitate a flow state.

2.7.3 Inclusion in this study and possible interrelationships

Grit is included in this research due to its strength as a stand-alone concept as well as its possible connections to some of the other fields being considered here, including SRL (in motivation), expertise and expert performance (in terms of how it facilitates hours of practice), and mindset (a growth mindset would

seem to be conducive to gritty performance). It is likely a facilitating system which is not necessary for success because grit can only clearly be seen in the presence of difficulties.

2.8 Summary

The systems examined in the literature review were chosen for this research based on several factors, including their value for explaining achievement as well as my personal experience of their utility for my students. All fields have robust findings in the literature and a view of their place in SLA could be enlightening.

The fields under consideration all have their own established means of data collection. The psychometric tests available for SRL, mindset, grit, and flow have been widely used and seem valid, so it was decided to use the available tests rather than to try to create new measures. Expertise and expert performance also has its own means of data collection, including think-aloud protocols and retrospective analysis, which are not amenable to psychometric tests. As such, data for this system lends itself to being gathered through an interview.

3 Research Methodology

This study is based on the premise that reality, as it relates to second language acquisition, cannot be precisely known; that data collected provides a limited view of a moment in space and time; and that any conclusions extracted are provisional. This postpositivist foundation has informed the methodology and methods of this research.

This study is predicated on the notion that degrees of attainment in second language acquisition are attractor states in a complex system of interacting components. Quantitative scales for data collection are used to determine how people are situated in these systems, and these scales have been shown to give robust and useful information, making them excellent choices for gathering data. Indeed, no better alternatives are obvious.

Not all the different fields of research being examined have appropriate psychometric instruments which can be adapted for the purposes of this inquiry. This is due to the amount of nuance needed to determine whether data is accurate. For example, asking about the amount of naïve, purposeful, proto-deliberate, or deliberate practice that participants undertake can be done quantitatively, but ascertaining that participants understand the difference between these types of practice is better facilitated and confirmed through discussion.

To determine the possible synergy of the system it is necessary to compare psychometric scores with levels of second language attainment. This requires some type of assessment or description of language ability levels. These levels can then be used to determine patterns in the psychometric data.

Correlations between levels of attainment and psychometric results will show if subsystems work together in relation to second language achievement but they will not give details of the relevance of the underlying factors in the lives of language learners. To provide practical details, it is essential to consider how these subsystems manifest in the real world. As such, qualitative data was obtained through semi-structured interviews to uncover specific examples, explanations, applications, and approaches, as well as to determine gradations of concepts.

Combining these approaches led to a sequential mixed-methods approach. First, demographic and psychometric data were used to find patterns. Participants were then chosen for interviews to provide depth of understanding for the patterns. Research question 1 (see section 1.5) is explored through psychometric instruments and question 2 (see section 1.5) is probed with a qualitative semi-structured interview.

3.1 Subjects

To deepen understanding of a complex system of second language learning a consideration of a wide range of language ability levels is necessary. Considering, for example, only high-level language learners will not give clarity to effective approaches to learning because it is possible that they are doing nothing overtly different from other learners. Examining differences between successful and less successful learners, however, can provide insight into how factors interact. Subjects for the interview, therefore, span ability levels from limited second language skills (tending towards monolingualism) to very successful language learners (hyperpolyglots), who match the expert profile being examined in this research.

Subjects in the typical range of second language ability were not difficult to find. Using social connections, including language teachers, for snowball sampling was the first approach to finding subjects. Social networks were the second avenue; networks such as Facebook have the advantage of being nearly worldwide allowing for subjects from a wide swath of humanity to be contacted—posts were made on language learning pages, including the Polyglot Conference page, asking for volunteers and, additionally, some posts were made on Reddit. Although there were responses from all over the world, my social network being centered in Korea meant that there was a disproportionate number of responses from that country.

Hyperpolyglots are a necessary part of this research because, ultimately, they represent the expertise and expert performance framework being examined here as outlined in the literature review, and it was thought that they would best illuminate the most effective interaction of the different factors being considered. The hyperpolyglots were found on YouTube, where many of them have their own language-learning channels, on message boards, where they communicate with one another, and at polyglot Facebook pages, where they socialize and often present their ideas and views on language learning. Email addresses were easy to find, and most were contacted this way, with the remainder being contacted by Facebook Messenger. Contrary to expectations, the response from hyperpolyglots was low. Nevertheless, several were represented in the psychometric testing phase of the research and one was involved in the interview portion of the research.

For the interview stage of this research it was felt that a consideration of learners representing a range of attainments would provide the best means of

comparison. Several participants were approached for interviews. Most requests were unanswered. Those who responded to the interview request all had a relationship to Korea, indicating a selection bias.

3.2 Data Collection

Choosing scales and measures for this research ranged from challenging, in the cases where many choices exist, to relatively simple, in the cases where there are few options. Many considerations guided choices for data collection. First, psychometric measures and scales should be either directly related to language learning or be general measures not focused on specific fields but easily applicable to second language learning—in the context of this research it would be of little benefit to analyze language learners on a test designed to get information about, for example, learning math. Second, questionnaires should be short to avoid respondent fatigue (Ben-Nun, 2008; Dörnyei & Taguchi, 2009).

The questionnaires were made available online and links were posted in several places (see 3.1.1). Some information was entered directly by respondents, such as languages spoken at various levels as described with the CEFR framework. The entire data collection form, including the CEFR self-assessment grid and all questionnaires, is in 7.1.

Data entered in the CEFR section of the questionnaire were used to group respondents. Total number of languages spoken was considered, as well the number of languages spoken to a B1 level and above level of proficiency and a B2 level and above level of proficiency.

The interviews were conducted on Skype and in coffee shops. The language of communication was primarily English, although when the respondents were discussing language learning the examples tended to be in Korean as this is the non-English language which we had in common.

3.2.1 Language Ability Scale – Common European Framework of Reference (CEFR) Self-assessment Grid

It is critical to know, at least roughly, participants' levels of language ability. Although there are numerous language tests available for many different languages, they were not attractive options for this research. Most tests are specific to individual languages. This means that a different test would be required for each language a person uses, making the process both protracted and convoluted. Second, paying for the testing of a bilingual or two is feasible, but a single hyperpolyglot would destroy a reasonable budget. Also, doing multiple tests would likely require much more time than a subject would be willing to give. The Common European Framework of Reference global self-assessment grid was determined to be the best choice for this research (see 7.1 Appendix A: Survey). It is a measure which is not specific to any one language so reduces complications. Second, the overall self-assessment grid from which it has been isolated has been found to be reasonably accurate (Rehorick, Jóhannsdóttir, Parent, & Patterson, 2010; Ross, 1998).

The CEFR global scale choice is pragmatic. Descriptors for the CEFR are concise, not requiring much time investment on the part of respondents, which helped to avoid response burden. Additionally, the scales are familiar to many language learners—CEFR references are in the blogs and on the videos made by polyglots such as Benny Lewis, Luca Lampariello, and Alex Rawlings.

The obvious objection raised against self-assessment is that of accuracy. That is, there is a concern that self-assessments are not reflective of skill levels. Research into this is mixed. Some studies show a lack of accuracy (Gardner, 2000; Matsuno, 2009) while others indicate reasonable accuracy (Bachman & Palmer, 1996; Patri, 2002; Stefani, 1994; Williams, 1992).

Issues with accuracy arise from different sources, with one of the main issues being that 'self-assessment' is a broad term which encompasses many different approaches, situations, and types of testing. Objections, therefore, are based on a broad conceptualization. That is, making a global statement about the accuracy or inaccuracy of self-assessment is as problematic as making a global statement about the color of flowers. A consideration and narrowing of variables in self-assessment can improve, or at least qualify, accuracy.

Accuracy seems to be better amongst subjects with higher levels of language proficiency. Engelhardt and Pfingsthorn (2013) attribute this to the Dunning-Kruger effect—those with low levels of ability do not have enough knowledge to adequately assess themselves and this results in overestimation. While this might prove an issue with those on the lower end of the second-language learning spectrum, the converse, that those with higher skill levels are more accurate in their assessments, means that hyperpolyglots are less likely to be far off in their self-assessments—according to Dunning-Kruger, such people would tend to underestimate slightly (Kruger & Dunning, 1999).

Second, descriptor styles of self-assessment are typically more accurate than other approaches. That is, self-assessments which are based on 'can do' statements are more likely to produce results in which the self-assessments

correlate with more traditional assessments (Ross, 1998). Self-assessment should, therefore, be based on descriptor scales.

For this research, subjects were directed to read each of the descriptors and asked to list any languages they can use under the appropriate description. Serendipitously, this also aided in discarding some responses as those who did not respond in this section correctly were eliminated from consideration (see 4.1 for more details).

3.2.2 Short Self-Regulated Learning Questionnaire (SSRQ)

The primary issue with measuring levels of SRL is that tests tend to be skewed toward specific fields of endeavor. The tests most used in research are the Motivated Strategies for Learning Questionnaire (MSLQ), which is for measuring self-regulation as it relates to academic study (Pintrich, Smith, Garcia, & McKeachie, 1991), and the Self-Regulation Questionnaire (SRQ) (Brown, Miller, & Lawendowski, 1999), which has several versions including an academic version (SRQ-A) (Ryan & Connell, 1989), a learning version (SRQ-L) (Black & Deci, 2000), and an exercise version (SRQ-E) (Eyck et. al, 2006). The specificity of some of these scales is a problem as the aforementioned versions of self-regulation measures will illuminate only some of the areas of interest in this study. Additionally, hyperpolyglots tend to be autodidacts, and even the more mundane of us typically do not attribute our language learning wholly to the classroom nor submit our academic grades as indicative of our language abilities. Perhaps the most common measure of self-regulation is the Self-Regulation Self-Report Scale (SRL-SRS) (Toering, Elferink-Gemser, Jonker, van Heuvelen, & Visscher, 2012). Unfortunately, it is somewhat long (50 items)

and seems more appropriate for students attending an educational institution, placing it somewhat outside of the focus of this research.

The option that most closely meets the needs of this research is the short self-regulation questionnaire (SSRQ; see 7.2 Appendix B: Semi-structured interview). The SSRQ is based on an analysis of the SRQ where it was found that 31 items are adequate for valid results (Carey, Neal, & Collins, 2004). The SSRQ version was used to see relationships between SRL scores and alcohol-related self-regulation but it is not an alcohol-specific questionnaire. The questionnaire has subsequently been used and found to relate to SRL in various contexts (e.g., Kraut & Seay, 2006; Seay, 2006; Vosloo, Potgeiter, Temane, Ellis, & Khumalo, 2013).

3.2.3 Flow Short Scale-2 (FSS-2)

In order to measure flow experiences in learning a language, subjects completed the Flow Short Scale-2 (Engeser & Rheinberg, 2008) (see 7.1 Appendix A: Survey). This instrument was chosen because it is both short and adaptable to any field.

The FSS-2 consists of 10 Likert-scale items each with a seven-level response. There are two sub-scales: four items relate to absorption in an activity and six items relate to the automaticity of the subject engaged in an action. The FSS-2 is designed so that both the activity and the action can relate to any area under consideration. Because it is short respondent burden should be low.

Although first used to measure flow in physical activities, the FSS-2 is applicable to different fields (Nakamura & Csikszentmihalyi, 2009). It is this

versatility that makes the FSS-2 a good choice for this study and, indeed, the FSS-2 has been used in such research (Engeser & Rheinberg, 2008).

3.2.4 Mindset

Mindset data was gathered using Dweck's (2000) Theories of Intelligence Scale (TIS) (see 7.1 Appendix A: Survey). This instrument is used to determine whether a person tends towards the fixed entity belief in intelligence or the incremental belief. As such, the results indicate whether a person has a fixed or a growth mindset.

There are benefits of using this instrument. It is very short, only eight items, reducing the chance of respondent burden. It is also a widely used instrument with various modifications, and while this does not ensure validity, no major shortcomings have been reported.

It should be noted that at the time the present research was undertaken there were no second-language acquisition scales for mindset; however, a study in 2017 by Lou and Noels presented a language-learning version of the mindset instrument. Unfortunately, this was not published until after the data collection was complete.

3.2.5 Grit-S

The Short Grit Scale (Grit-S) was used to gather data related to grit (see 7.1 Appendix A: Survey). The Grit-S scale has been found to be positively correlated to 'success' in many different areas relating to achievement through perseverance over a long term (Duckworth & Quinn, 2009). Like the TIS, the Grit-S is very short, eight items, making it unlikely to feel burdensome to subjects, thereby encouraging a higher completion rate.

3.2.6 Semi-structured interview

To determine how the psychometric measures are expressed in the lives of learners it was essential to get more detail than numbers can give. To this end a semi-structured interview was conducted where additional questions relating to the fields of research involved with subjects' psychometric scores were discussed (see 7.2 Appendix B: Semi-structured interview). Also, information relating to expertise and expert performance, particularly types of practice, was elicited.

Respondents were given a short synopsis of each area of research covered in this study, a summary of their scores on the psychometric tests, and were subsequently asked for their thoughts. The purpose of this portion of the research was to get further insight into how these different areas of psychology manifest in the lives of these language learners.

Subjects for the interviews were chosen to represent different areas of second language ability. Hyperpolyglots, obviously, were one of the groups; additionally, monoglots, or a near-monoglots, represented the other end of the spectrum. Other participants fell between these extremes. Answers from the different respondents were compared for detail and depth as well as insight. For example, when describing study techniques or approaches those nearer the monoglot end of the spectrum tended to give much simpler answers than those on the higher end of the scale.

3.2.6.1 Expertise and expert performance

Because it has no psychometric tests available, expertise and expert performance data had to be extracted by first counting the number of languages

spoken by the respondents, and second, through asking questions in the interviews which related directly to practice.

As discussed earlier, there are many possible expert profiles in second language learning. For this research the primary definition of expert is the same as the definition of hyperpolyglot–a person who has learned six languages to a communicative level (level B1 on the CEFR self-assessment grid). This part of the measure of expert is quite easy because experts can be classified from their CEFR self-assessment grid responses.

Somewhat more difficult to ascertain is the amount of practice undertaken to reach high ability levels in multiple languages, and even more difficult to establish is the percentages of naïve, purposeful, proto-deliberate, and deliberate practice involved. Determining the amount and quality of practice has been approached in a few different ways in research, including diary studies and speak-aloud protocols, neither of which was appropriate for this research. Diary studies are typically used for longitudinal research or for people presently involved in an activity; this study is not longitudinal, and some subjects are not actively learning a language. Speak-aloud protocols are used, typically, with specific tasks done in a laboratory setting, but this study is not focusing on the small scale. To get around these issues retrospective estimates of practice hours was the method of choice for this research, although such estimates do have some problems.

The first issue with retrospective estimates of practice is that they tend to be too high (Ward, Hodges, Williams, & Starkes, 2004). This lack of accuracy in estimated hours is not, however, crucial. This study intends to consider relative hours rather than absolute hours. That is, whether or not experts and beginners

both overestimate the amount of practice they engage in there is no issue as long as they both overestimate by similar amounts. Fortunately, this seems to be case. In studies in which hours of weekly practice were logged it was found that there is a correlation between higher estimated hours of practice and higher actual hours of practice. That is, those who estimated higher hours, while not practicing as many hours as they estimated, did practice relatively more hours than those with lower estimates (Ward et al., 2004).

Determining the quality of the practice is a much thornier issue as expertise and expert behavior is, to a large part, a consideration of the quality of practice. Researchers in this field contend that naïve practice does not lead to high levels of ability, that purposeful practice can lead to high levels, and that deliberate practice is necessary for world-class performance (Ericsson & Pool, 2016). There are parameters for analyzing practice to determine whether it is deliberate practice, which include motivation, an accounting for pre-existing knowledge, immediate informative feedback, and a repetition of tasks. Additionally, to improve, individuals engaged in deliberate practice actively search for and try new strategies and methods. This is typically done with an instructor designing activities and the majority of the practice being done alone (Ericsson, Krampe, & Tesch-Römer, 1993).

Using these parameters to create questions, the amount and quality of the practice was teased out. Questions related to descriptions of motivation, how learners determined what to practice/study (or how it was determined for them), what kind of feedback subjects sought out and/or received, and how subjects approached repetition.

To ensure that answers were pertinent it was felt best to use a semi-structured interview format. A semi-structured format allowed for the interview to be guided so that subjects gave more depth to their explanations, which is especially important in cases where nuance and more complete explanations are needed.

3.2.7 Data collection

Data collection was undertaken in two ways. First, there was the online component. Before conducting the tests, respondents were asked to give some demographic information as well as invited to participate in a later interview.

Once registered, subjects were asked to complete quantitative measures relating to learning, including the mindset instrument, the grit instrument, the flow instrument, and the SRL instrument. All data collected in the quantitative portion of this research was saved for analysis and stored on a secure server.

The interview portion of the research was conducted face-to-face where possible, and on Skype when such a meeting was not convenient. Interviews were recorded for analysis and coded according to relationships with the systems being considered as well as their subsystems. For example, salient points about hours of practice were coded both generally and in terms of quantity and quality.

3.2.8 Data analysis

The number and level of languages spoken by respondents was calculated and organized using Microsoft Excel. Psychometric test results were analyzed using SPSS. Cronbach's Alpha was used to check for consistency and Spearman's rho was used to check for correlations between factors.

Correlations from Spearman's rho were used to get a low-resolution view of interactions.

The qualitative data from the interviews was transcribed and imported into NVivo. The interviews were coded according to the factors under consideration and additional codes were used for points of interest uncovered in the course of analysis (see 7.3 Appendix C: Interviewee Consent Form for a screenshot).

3.2.9 Ethical considerations

That participants are not subjected to harm in any form is a consideration of all research. Feeling compelled to participate or having personal information accessible by other parties are areas which were identified in this study as possible issues. In order to minimize the chance of harm or discomfort to the participants, precautions were taken.

All online participants were informed of the nature of participation in the online form and asked to confirm their understanding of this. Additionally, interviewees were presented with a consent form at the time of the interview and informed that they could withdraw at any point. Interviewees were subsequently asked to verbally convey their willingness to participate (when interviewed online) or asked to read and sign a form (7.3 Appendix C: Interviewee Consent Form). Efforts were made so respondents would not feel compelled to participate nor continue if they felt uncomfortable.

Next, where personal identification of participants could be an issue, efforts were taken to minimize the chance of information being accessible by other parties. Responses to the questionnaire, including demographic information, were kept confidential and stored on a secure server. Additionally, it was felt that there could be privacy issues with some of the details given about the

interviewees in that they could be identified by some details of the content. To minimize this the interviewees were given drafts of their biographical information and asked about any concerns. Based on responses one pseudonym was changed and some details of the biographical descriptions were altered.

Ethics approval was obtained from the University of Exeter (see 7.5 Appendix E: Ethical Approval). In the course of the research, aside from the possible issues discussed above, there were no apparent concerns.

4 Results

This section presents a brief demographic overview of the participants, which is followed by the quantitative results. The qualitative results are then presented according to the themes covered in this research. The presentation of the material is ordered around answering the research questions, although the research question hypotheses are considered in next section.

4.1 Respondent overview

Over 230 people responded to the online form although some responses had to be discarded. The reasons for elimination included incorrect information entered in text boxes, such as writing a short narrative unrelated to the research (e.g., “He travel always 60 kilometers because her school is 60KMS from home”); typing ‘yes’ in language fields instead of listing languages spoken; and, additionally, three respondents indicated in the text boxes that they had incorrectly or insincerely filled out the questionnaires, purposefully, for reasons ranging from a lack of understanding of the questions to objections to psychometric tests; for example:

> I didn't even read the questions. Dude, "most people in the world" are not alike! So there will, in fact, only be wrong answers on here since no one knows enough people in the world to be able to estimate such vastly different people with respect to themselves.

Incorrect information, such as with the short narrative example above, indicated that the instructions were not being followed, hence the exclusion. Comments such as the objection to psychometric tests above also indicated that the fields had not been filled out accurately, so these were also excluded. These issues resulted in the number of valid participants falling to 196.

As a group the participants in this research spoke an average of 4.57 languages, inclusive of low levels of ability. The average number of languages spoken at B1 and up was 3.06, and at B2 and up was 2.42 (Table 3). The languages spoken represented nearly 100 different languages in multiple language groups. Also, because the form was in English only people who could use English took part.

	total languages	languages B1 and up	languages B2 and up
Mean	4.57	3.06	2.42
Median	4.00	3.00	2.00
Mode	3	2	2
Std. Deviation	3.365	2.235	1.633
Maximum	25	19	15

Table 4-1 – Overview of Languages

Participants ranged from monolinguals, those reporting facility with only one language, to the other extreme of hyperpolyglots, with the highest reported number of languages spoken, inclusive of all levels of facility, given as 25. The highest number of languages spoken at a high level (B2 and above) was reported as 15.

There are limitations with the demographic data. A field for birth year was on the form but it was not mandatory and about 25% of respondents left the field blank. Nationality and cultural background were also requested, but this proved to be a morass that could not be easily navigated; the greatest number of respondents was from the United States (43), but the next largest group was the hyphenated and non-traditional group, which included common hybrid descriptions such as “Korean-American,” and also harder to determine cultural affiliations such as “white.” Additional issues with making clear classifications, came with the listing of cultural background as “European,” which could refer to the previously mentioned “white,” of European descent, from a country that is part of the European Union, from any country in Europe, or could be reference

to an idea of a meso-cultural group called ‘Europeans’ which transcends nation states and could be referring to any combination of factors.

Finally, some potentially useful information was not gathered. It would have been worthwhile to collect demographic information such as level of education, type of education, socio-economic status, etc.; these were initially deemed too intrusive to include, but on reflection, perhaps a way to collect this information could have been determined. Other information such as occupation and sex were not initially considered for inclusion but could have been illuminating.

4.2 Results of quantitative data

Quantitative data consisted of scores from Likert-scale questionnaires. Both raw scores (all items of each scale) and the scores for each scale were imported into SPSS for analysis. Cronbach’s Alpha was used to check internal consistency of scales and correlations were measured using Spearman’s rho. The psychometric tests used different ranges of numbers in the Likert scales so for ease of comparison all numbers were calculated to represent a 5-point scale. For example, the FSS-2 and the Short Grit Scale both have Likert scales from 1 to 6, while the SSRQ and the Mindset Instrument have Likert scales from 1 to 5. The FSS-2 and the Short Grit Scale were mathematically changed to match a 5-point scale.

4.2.1 Instrumentation and Reliability

The psychometric instruments (SSRQ, Mindset Instrument, Grit-S, and FSS-2) used in this research have all been determined to be valid by other research (see sections 3.2.2, 3.2.3, 3.2.4, and 3.2.5). Each of the scales was checked for reliability using Cronbach's Alpha (Table 4-2). Both the SSRQ and the Mindset Instrument showed excellent internal consistency with scores of .927 and .950 respectively, while the Grit-S and the FSS-2 showed good internal consistency with scores of .844 and .806 respectively.

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
SSRQ	.927	.928	31
Mindset Instrument	.950	.950	8
Grit-S	.844	.845	8
FSS-2	.806	.813	10

Table 4-2 - Instrumentation Reliability

4.2.2 Correlations

Spearman's rho was used to check for correlations between all psychometric tests and the number of languages spoken at a minimum level of B1 (Table 4-3) and, separately, the number of languages spoken at a minimum level of B2 (Table 4-3). Spearman's rho was used because the data is right skewed—there is no (mathematical) limit on the number of languages a person can speak but there is a minimum (it is necessary to know at least one language to do the survey and it is impossible to know a negative number of languages)—and because there are outliers (the hyperpolyglots).

Based on Field's recommendations for interpretation (2009), effect sizes with the factors in both language conditions were found to be small. The relative strength of the relationships to both language conditions showed SRL to be strongest overall, followed by other factors showing influence in the same order

of effect size: consistency of effort (note: grit was broken into its separate factors), flow, mindset, and the grit factor of consistency of effort.

	languages B1 and up	languages B2 and up	SRL	Mindset	Grit	Consistency of Interest	Consistency of Effort	Flow
languages B1 and up		.886**	.151*	.048	.035	-.064	.142*	.141*
languages B2 and up	.886**		.192**	.099	.117	.037	.189**	.147*
SRL	.151*	.192**		.271**	.650**	.435**	.697**	.420**
Mindset	.048	.099	.271**		.200**	.128*	.230**	.090
Grit	.035	.117	.650**	.200**		.857**	.850**	.294**
Consistency of Interest	-.064	.037	.435**	.128*	.857**		.480**	.217**
Consistency of Effort	.142*	.189**	.697**	.230**	.850**	.480**		.341**
Flow	.141*	.147*	.420**	.090	.294**	.217**	.341**	

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table 4-3 – Spearman's rho

As the factors related to each other, effect sizes tended to be stronger than with languages spoken, although only the relationship between SRL and grit notably so.

4.3 Results of qualitative data

Qualitative data was gathered because it allows for a more complex view of the quantitative results. Semi-structured interviews were recorded, transcribed, and coded in NVivo (see 7.4 Appendix D: NVivo Screenshot). Reponses relating to SRL, mindset, grit, and flow were included, and the additional research area of expertise and expert performance was also coded by considering hours spent learning and the quality of those hours, although this proved to not be easily quantifiable. Grit was subsequently coded into its factors of consistency of effort and consistency of interest. Finally, other recurring themes, ideas, and interesting points were coded, including motivation, and

image and identity. Although the interview was divided into questions intended to elicit data for specific topics it was often the case that comments from one area were relevant to another area; some quotes, therefore, appear more than once. Where quotes are used in the following sections, they have been tidied up to avoid repetition, false starts, and fillers.

4.3.1 Summary of interviewees

Participants for the qualitative data collection were selected for different reasons. Primarily, representatives of different points on the continuum of language learning capabilities and accomplishments were thought necessary to get a range of experiences and views and, specifically, to get the views of a hyperpolyglot. DM, the hyperpolyglot interviewed in this research, speaks six languages at the B2+ level, an additional four languages when the B1+ is used

PARTICIPANT	CEFR Levels						Attained language levels		SRL	Mindset	Grit	Flow
	A1	A2	B1	B2	C1	C2	B1+	B2+				
EM	French		Korean			English	2	1	3.1	2.0	2.1	2.3
AL	American Sign Language	Spanish	Japanese	Korean		English	3	2	3.5	3.4	3.3	3.7
TY	Japanese, French		Spanish	Korean		English	3	2	3.7	2.5	3.3	3
AS	Bengali		German, Korean		Hindi, Marathi	English	5	3	4	4.3	2.6	3.9
DL				Korean	French, Spanish	English	4	4	3.9	2.1	2.5	2.7
DM	Estonian, Swedish	Afrikaans, Norwegian, Dutch, Bulgarian, Persian	Portuguese, Italian, Turkish, Spanish	German, Mandarin, French		Korean, Japanese, English	10	6	4.7	4.2	4.3	4.5

Table 4-4 -- Participant Overview

as the cutoff, and another 11 languages reported at levels below those. A short biography of the interviewees is in 7.5 Appendix F: Interviewee Bios.

Additionally, there were practical issues of convenience and expediency which resulted in all candidates having a relationship to Korea and Korean. Six people were contacted through social media or email and agreed to be interviewed either face to face or over Skype. Interviewees were divided on the breadth of their self-reported language capabilities, although, except for 'hyperpolyglot,' no firm categorizations were made, reflecting the morass of a reality in which discrete categories are a convenience.

Additional issues exist with the identification of a first language or languages. For example, one candidate can be said to have three mother tongues, while another stated that her mother tongue is Korean although she rates her Korean at the low-intermediate level, having not achieved high fluency before moving to the United States and becoming immersed in English. Rather than force a categorization on these it was decided to not use this classification. Also, traditional classifications of gender and age were not included, and this was decided because neither gender nor age seemed to be used in previous studies of the factors being considered in this research.

4.3.2 SRL

All interviewees, as predicted by Zimmerman (2002), showed some use of SRL. Comments related to goals and interests, a part of the forethought phase of Zimmerman's model; self-instruction and task strategies, relating to the performance phase, were also mentioned; and finally, some aspects of the self-reflection phase were touched on.

4.3.2.1 Forethought phase

Zimmerman's (2002) description of the forethought phase of SRL is broken into task analysis and self-motivation techniques (see sec. 2.3.2, fig. 3). Goals

are a part of task analysis and were often mentioned by the interviewees, most often in the context of motivation. For some of the interviewees, goals were specific, while for other interviewees they were hazy. Both distal and proximal goals were described and were often seen as a means of motivation.

For DL, ease of interaction in Korean was a distal goal, and he stated that he wanted:

> *DL: to speak Korean well enough that I could turn on a movie watch it just to enjoy it do the same with the news and meet and talk to people … as comfortably as if I was speaking English with them*

Such a goal is probably not unusual amongst language learners as, anecdotally, it is not uncommon to hear similar distal goals pointed towards a hazy point in the future where an advanced level is achieved, and interaction becomes easy.

DL also mentioned a proximal goal in relation to classes and formal tests as well as how he worked towards it:

> *DL: I picked up some books and practiced with old … TOPIK* [Test of Proficiency in Korean] *tests.*

For this goal DL was focused on achieving a level 6 TOPIK score to qualify for a Korean residency visa. His goal, then, was less about fluency in Korean and more on passing the test. TY, likewise, had the same goal:

> *TY: I wanted to get level 6 on the TOPIK test it's a good goal it's the highest level*

For TY this goal was twofold: one, to achieve it to show that he could, and, two, to get points to qualify for a residency visa.

AS also referenced examination performance as a goal. Although she mentioned specific exams, she stressed that studying for any language exam is a good goal:

> *AS: So, one of the things for me was … exams … when you have exams it's … a goal … you need to get through*

As with DL and TY, AS had a goal of doing well on a Korean language exam, the KIIP (Korean Immigration and Integration Program) proficiency test, to qualify for a Korean residency visa.

Goals were also not always clearly defined, indicating a weak element for some of the interviewees and, interestingly, two of the interviewees who did not show strong interest in the residency visa, EM being satisfied with his work visa and AL qualifying for her residency visa based on her ethnic background, also did not have clear or substantial goals for their Korean:

> *EM*: *I know vaguely where I'm going … I guess I have a few specific goals but they're not really what… I guess I… feel like I have a bigger goal than those more specific goals.*

EM does not extrapolate and explain his goals, however, and they remain hazy and undefined, so they seem to contribute little to his motivation.

AL similarly has no clear distal goals in her language learning beyond the dim and undefined. She does express that she has some proximal goals, or has some proximal goals at times:

> *AL: But my goal… well I guess when I do that one page of the book each time … my goal is to understand every word that is on the page and if I don't I write down the little meaning on the sides*

However, this describes something which sounded in the interview like an afterthought. It is not a clearly considered goal and as a proximal goal it can be achieved without a great deal of effort.

DM, the hyperpolyglot in the study, provided more depth and detail in his answers than the other interviewees. He described distal goals in terms of the proximal steps needed:

> *DM: The three-month period in 2002 … I found a Dostoevsky book that I decided I was going to read from cover to cover … in Korean and I spent probably every day from about two to eight at Starbucks I was trying to get through that book … I calculated it would take about 80 pages a day.*

This depth of description with his goals is indicative of the answers that DM gave. He has a distal goal of being fluent and has proximal goals set out to achieve this, such as finishing a novel in Korean and breaking it down into daily steps that must be achieved.

A connection between goal setting and self-motivational beliefs in Zimmerman's framework is clear as he includes both in the forethought phase of his model. The intrinsic value of an activity is a central part of flow (flow is treated separately in section 4.3.5). Intrinsic value was also mentioned by several of the interviewees. For example, AL stated that she "got interested in the Japanese language itself," EM remarked that "it's fun to learn a language," DL mentions that learning French and Spanish allowed him to fantasize about life outside of his hometown, while TY said that "I just learned to love it. That's why I study in the end."

4.3.2.2 Performance phase

Self-instruction was mentioned by all the respondents. Some of the respondents showed an unrefined approach to self-instruction in which there was no clear structure or approach to language learning; some showed a mix which was seemingly dependent on the language being learned at the time; and some showed a strong awareness and implementation of language learning methods and techniques.

Responses which displayed an unrefined approach to self-instruction tended to show a lack of systematicity:

> *EM: I might just be taken by sudden interest in something like a song I want to know what … that song is about. I want to know the lyrics. So, I might spend some time looking at the lyrics of that song ... sometimes … I go through periods I want to read the news in Korean so every morning I'll like look at what's the number one story and then I'll just … translate the headline and if I can get a bit further … translate the first one or two sentences.*

What is notable for EM is the lack of a firm approach in which learning is a bit of aimless puttering with no depth or follow-through. This is also apparent with AL:

> *AL: I have a lot of books so one thing I want to still do is learn… well, get more fluent in Korean and I have a lot of books… textbooks… but the problem is looking at them I don't know why I bought a … self-study book for elementary school students … because I only went to kindergarten in Korea and just the moment I open that book and I see two lines I … struggled to read it I don't want to read it.*

A general idea of how to learn is present, AL has purchased books to read, but there is no deeper consideration of the quality of the book choice nor indication of progress. That is, AL buys a book, toys at reading it, and then quits. For her, the performance phase of SRL is not robust.

Responses often seemed dependent on the language being learned. DL relates how French and Spanish were easier to study because of an ease of comprehension, while Korean was a slog:

> *DL: French and Spanish are similar enough to English that it's easier … to guess words from context when I'm reading or and I'm listening it's easier for me to ask questions ... and understand the answer ... it's easier ... to enjoy what I'm ... doing than I've ever found it to be ... with Korean… it feels like ... work ... where I've never... found materials where I can just read them ... the ... North Korean refugee memoirs I would take months to get through ...*

DL continued to describe situations in which learning and using Korean were difficult while having little difficulty with French or Spanish. This indicates that the performance phase is, for him, dependent on considerations beyond a general implementation which could be applied to any language learning; that is, DL's SRL is affected by the specific language being learned.

DM, the hyperpolyglot, in the situations he described, tended to show a systematic approach to, and clear awareness of, learning both in terms of hours as well as materials. For example, when a period of free time was available to him, he decided to work on his German:

> *DM: … they said it* [a new job] *would start in three weeks and I decided that was a perfect time to … transcribe* Damien*, the German book … I had the audio file… it was six hours long and so what I did was I … used* Audacity [an audio editing program] *… So I use that to … select … five seconds at a time … hit the spacebar with your left hand … write it with your right … and I managed to do it all within three weeks … you … try your best and then sometimes you don't know … what it said and then just open up the book and … check and … use your hand to make sure you don't look ahead …*

DM, unlike that the other interviewees, clearly describes not only why he chose specific materials (in this case it was the availability of audio and complementary written materials), he also clearly sees the necessary time commitment, follows the schedule that is needed to achieve his goal, and clearly explains how he performs the task.

4.3.2.3 Self-reflection phase

Self-reflection, according to Zimmerman (2002) is broken into two aspects: self-judgment and self-reaction. Part of self-reaction is adaptive reactions in which learning is adjusted and improved. AL and EM showed little in the way of adaptation. AL described several small forays into different ways of learning but little on modifying those methods, while EM described minimal adaptation to his study methods:

> *EM: Or maybe just tweaking. Like for example I used to use … ANKI for flashcards. Now I use Quizlet. Just changing to a slightly new format is enough to make it less tedious… I've done language exchanges… I've done that trying to get speaking practice… I don't really try and learn from Korean movies or television shows I've done little bits like I've looked at some scripts. I've looked at some lyrics for …music occasionally.*

This reflection by EM lacks analysis and depth. There is recognition that his approach to study is tedious, but the only change is to 'make it less tedious' rather than considering, for example, how it can be made interesting. There are sallies into various other opportunities to learn, such as language exchanges and target-language media, but no reflection into how to improve their efficacy.

DL showed adaptation in different ways. First, finding target-language media which could maintain his interest as well as finding opportunities to compensate for a lack of progress:

> *DL: I took a lot of responsibility for learning Spanish … and Korean. I spent about a year and a half … relearning Spanish after living here* [Korea] *preparing to go to Central America and I found materials … to read that interested me I started reading the news … a lot in Spanish I started finding music I was interested in listening to and … I started finding … ways to make it a hobby to integrate … into my life. With Korean when I wasn't in class I was always looking for movies. I didn't like Korean TV but Korea has … a pretty good cinema … industry so renting DVDs and learning … watching and re-watching some movies that I really enjoyed … that's how I study … independently … finding some aspect of the culture … I can integrate into my life as a hobby and going … and pursuing that for a while in Korea I was also reading memoirs of North Korean defectors*

DL shows that he has reflected on the efficacy of the materials which he uses to learn languages. For both Korean and Spanish, he made an effort to find materials which were interesting and rejecting, as in the case of Korean television, materials which were not interesting. He also shows an analysis in his reflection of his formal Korean studies:

> *DL: I found textbooks and studied … on my own and I did improve a lot, but I think that if I had found… the Sogang Language Institute* [a well-known Korean language school in Seoul] *I … would have accomplished the same amount in far less time … when I moved to Seoul and had access to Korean classes I progressed … much more quickly … than I did … studying independently*

In this, DL shows the reflection that led to finding and participating in, for him, a more effective way of learning.

AS described creating motivation to maintain effort in learning Korean, which she did by putting herself in a situation where she had to study for an exam:

> *AS: … taking control and responsibility for my learning... I feel that you always need some kind of motivation or anything when you want to learn something … so one of the things for me was … exams … when you have exams it's like a goal … you need to get through that so that is one of the things which motivates you to probably study … I was trying to give up before yeah I did it for two months seriously and then I kind of got bored … because I was doing it alone and then … I would practice it with other Koreans … but still … I didn't have that something to motivate me something … for me to look forward to I have to hit this I have to … get through this. Since we had the … KIIP* [Korean Immigration and Integration Program] *… you have an exam and then you have … the next level so it's like a motivation … it sets some kind of a goal and I think that was more interesting which makes the learning process even more interesting so you focus … even if you feel sometimes lazy you know that there's an exam coming up so you will study for that*

With AS the reflection on her learning, as with DL, led to enrolling in language courses because she realized that impending exams lead to motivation and effort while learning on her own led to giving up. Her positive changes, based on her self-reflection, helped her learn Korean.

TY credited his ability to learn Korean partly to his choice of study methods, describing media that he consumed as well as different ways to learn vocabulary. Also, TY credits his success in language learning with his own efforts, showing causal attribution in terms of study choices and well as self-satisfaction:

> *TY: You always have your own perspective and I don't know if other people are somehow unaware of how to motivate themselves … but I do I am very aware of when I'm motivated and when I'm not. I have a fairly strong theoretical sense of why I would be or not … I always like to say I never took a class … and it is a bit of a brag … but my Korean is still better than almost anyone I know and I think that that without even further comment I think that kind of addresses the point like I didn't need a class or a teacher …*

TY shows how he reflected on his motivation for language learning as well as the underlying reason why he is or is not motivated. This shows a depth of self-understanding that is not present with EM or AL, who both seem to stop their reflection at an acknowledgement that the materials or approaches they are using are not interesting, useful, or motivational, but do not take the extra steps of considering why their study choices are not interesting or how to change them. Unlike DL and AS, TY did not need a teacher for learning Korean, being able to both motivate and direct himself.

DM, the hyperpolyglot, did not mention self-evaluation in the context of self-judgment. Rather, the whole of DM's interview dealt with self-satisfaction and affect. His descriptions of studying had more detail than the descriptions of the other interviewees and his satisfaction with his effort and his outcomes was clear. Additionally, when considering tasks that others might find dull, DM showed that he can find a way to make things interesting. For example, in describing studying grammar DM shows an awareness of how to approach it in an engaging manner:

> *DM: Grammar gets really interesting when you've seen a lot of language in context … you read like two or three pages and then you … see all these obvious structures and then you'll pick up a grammar book … and then you realize oh that's the thing that I saw back there that's … the verb form that I just read and if you do it the other way around it's not so it's not nearly as effective.*

So, while AL and EM do not consider in depth the smaller points which could make their learning effective, DM has analyzed and utilized a simple approach: studying grammar after being exposed to a lot of the language. It is this type of analysis and application that runs throughout DM's interview.

4.3.3 Mindset

Views on mindset varied. Although the technical definition was given to the interviewees (see 7.2 Appendix B: Semi-structured interview) some of them related it to the colloquial meaning of the term in which mindset deals with a specific way of thinking but not a growth or fixed mindset. For example, AL indicated that there is a middle ground between talent and effort, but then moves into an answer indicating a more general use of the word 'mindset':

> *AL: I would say I'd say it's somewhere in the middle* [her mindset] *… because … I do try to keep my mind open to different concepts. For example, how we place words differently like in Spanish compared to English you have to keep thinking in that mindset.*

Although there was some confusion about the term, the interviewees also had answers related to the technical meaning. There was a tendency for some interviewees to equate language learning success to a growth mindset on the one hand and a fixed mindset on the other. EM, for example, indicates a fixed mindset in one aspect:

> *EM: I think some people might … feel like. I've learned too much. And I guess some people might have a higher threshold.*

That is, the ability to learn might have a fixed threshold in which some learners can push themselves more, which is a belief in a fixed ability or capacity; however, in talking about the students in his Korean course, he relates:

> *EM: You realize that no one is no one is soaring ahead because they have some kind of innate talent. Everyone is just developing according to how much I think they put in*

In this instance, EM is showing a growth mindset in his interpretation of the levels of success with his classmates. Finally, in his own case EM shows that he, perhaps, has a growth mindset:

> *EM: Well the only time I've gotten better speaking Korean is when I put effort into learning it.*

It is, however, unclear whether EM considers that there is a necessary minimum level of innate ability, such as with a threshold for time on task, upon which effort can build.

AS describes measures of both talent and effort as being necessary for learning, showing that she attributes success, at least somewhat, to a combination of innate abilities and effort:

> *AS: So, I think … partly talent and partly effort… Well I think it's 50% … effort it depends from person to person*

For AS, then, both, talent and effort, conditions are necessary to learn.

DL states that talent might exist but that it would only manifest in conditions where the target language is not difficult to learn. Additionally, he believes that effort trumps talent when engaging in learning a more difficult language:

> *DL: If I have to choose just between talent and effort … I would say effort because I have known a lot of … people who seem to have a talent for it but … if they don't put in … the work especially with an Asian language you don't just pick it up … I think with a language that's more similar to English like French or Spanish … you could just be talented and move to someplace where you're immersed and … pick it up just from … watching and learning and watching and listening and meeting people … I think you could pick things up … but Chinese Korean Japanese are just too far different … there's a real limit to how much you … can pick up as an adult without putting in … some study first but to me talent versus effort seems like a false dichotomy*

His belief matches that of AS: both talent and effort are necessary. DL goes a little farther, however, in explaining that the mix of each is different in relation to the language being learned.

TY has a less strong view of the necessity of talent, but he considers the possibility that talent is a necessary condition for success in learning a second language:

> *TY: I guess I'm a bit fatalistic … I would just say … if you haven't learned the language and if you don't want to learn it that probably means you shouldn't or that you don't need to or … maybe even that you can't.*

Interestingly, for TY the idea that a person 'can't' learn a language is an afterthought, expressing that motivation is more likely a candidate for second-language success than innate considerations. More evident, however, is the value that TY sees with effort:

> *TY: Well I suppose the obvious point is that if you believe you can't grow then you probably won't*

This statement echoes Dweck's research: a belief in the lack of innate ability can lead to a lack of success. TY dismisses the fixed mindset in relation to himself:

> *TY: My knee-jerk reaction is talent isn't that important … anyone could do it and it is true when I ask people I get a mix of answers and like why didn't you learn a language a lot of people say well I'm not able to… And I've always been somewhat dismissive of that point … I feel like … talent is … an excuse … not to do it, but that's not fair. I don't know what other people feel. People always say I have a talent. I don't think that's true.*

So, TY feels that maybe talent exists, but he does not feel that it is not a factor in his own case and sees the belief in a lack of talent as an excuse for others to not learn a language—a strong growth mindset despite the 2.5 which he got on the TIS.

DM, the hyperpolyglot, shows a strong tendency towards a growth mindset. He states that there are possibly outliers who cannot learn a language, but they are exceptions:

> *DM: I think there are people that just can't learn languages … they probably exist, or they do exist, but besides that I think it's mostly the growth mindset.*

When problems arise in language learning DM does not see an issue with talent or aptitude but an indication of where effort should be placed:

> *DM: If I've had … an experience where I've felt like … I'm really weak here like if I'm … learning a language and then I talk to somebody and then I realize that I'm terrible at verbs and … there are all these*

> *irregular verbs and I haven't given them any time … I'll spend … the … next week or so just working on that.*

For DM a lack of facility in a certain area is something that can be overcome by effort, showing a clear tendency towards a growth mindset. This is also related to deliberate practice as experts typically focus on where they are weak rather than where they are strong (Coughlan, Williams, McRobert & Ford, 2014).

4.3.4 Grit

The primary issue with discussing grit, as with mindset, is that the definition has some fluidity in the minds of the interviewees. Duckworth's definition is that grit is passion and perseverance for long-term goals (Duckworth, Peterson, Matthews, & Kelly, 2007) but often the interviewees described spurts of intensity and situations in which grit was equated with effort but not over the long-term. Nevertheless, answers given typically showed whether an interviewee had grit.

DL, for example, describes how he maintains motivation, and in this description he gives some insight into his grittiness:

> *DL: I find … external motivation … has determined … how much time I put into studying than anything else when the motivation is there I find the grit. When the motivation is not there I find other things … to focus on and study. … I actually think I do have a fair amount of grit when I have enough reason to do something I want I could put in the effort to do it.*

DL equates grit with general effort rather than a particular effort needed when encountering obstacles such as a lack of motivation, which indicates a misunderstanding of the meaning. That is, if he were gritty, he would push through a lack of motivation.

EM also did not have grit and he understood this about himself:

> *EM: Well I don't feel especially gritty … about learning Korean simply … because it's not the highest priority thing for me… I'd like to do better. I have a certain amount of motivation to do it. But if it became very difficult then I probably think … I can take a rest then and pick it up again later.*

Grit is related to *not* taking a rest when things become difficult and, instead, consistently putting in effort. EM, then, seems to have analyzed himself according to the definition of grit used by Duckworth and identified as being not gritty.

Not pushing through difficulties was also shown by other interviewees:

> *AS: I can try or make an effort, but I feel not for too long so that I want to see results faster. I can have patience for some time but if I fail too many times … probably I might give up at some point. I would not go on and on. Then I would try to change my plan somewhere. But if I have a strong feeling about something. Yeah, I would want to try. But if I fail too many times I think I might give up.*

Clearly, AS is affected by adversity and her persistence has a limit.

Although they showed it differently, TY and DM revealed much more grit in their answers. TY displayed grittiness throughout his language learning process including fighting to get into Spanish class and pushing through blocks to learning:

> *TY: So, my reasons have always been passion … I literally argued my way into Spanish class in high school they weren't going to let me take it.*

Additionally, TY shows Machiavellian motivation, a desire to overcome a group of people (Oller & Perkins, 1978), and this seems to be a large part of his development of grit for learning Korean.

> *TY: if you ask me what is grit it's the anger and the … fury at the at the goal of someone else to stop you or I guess you could even say of any given issue or any given challenge to stop me like the sheer sense of I can't allow this to… I can't stop now because I'll regret it forever.*

In this case the Machiavellian motivation is what triggers grit in terms of persistence, and TY goes on to explain the impetus for his grittiness:

> *TY: in Korean definitely … grit in that sense … maybe it's your sense of your own power and your own control of the situation which is undermined … particularly in language learning you got no power* [if] *you don't speak the language that's being spoken … If you can't be in the conversation, you're voiceless… if you want to assert yourself … for negative reasons … you've got to get in there and you got to show them*

you got to prove yourself.

For TY, then, grit is clearly a factor in his perception of his learning.

DM, unlike TY, has a more pervasive and a less Machiavellian conception of grit. His determination is apparent in how he overcomes 'small things':

> DM: *The funny thing about the dictation is … if you do this too much … holding the pencil … you'll start bleeding here. By the end I had three cracks here and luckily it happened near the end, but it took about two weeks for it start bleeding*

Studying hard enough to draw blood is an image which encapsulates DM's attitude, but grit is not only working through a few challenging times, it is working through them over the long term. DM finds ways to make time to learn:

> *DM: When times are hard … I don't have enough time and I will just reallocate … whatever spare time I have… so instead of like doing an hour of this and an hour of that it becomes 30 minutes of this and 30 minutes of that*

With time considerations of language learning (see 4.3.6, Expertise and Expert Performance) it is easy to see how, while others might use a lack of time as an excuse, DM pushes through to use as much time as he can get rather than quitting.

4.3.5 Flow

The interviewees seemed to have varied experiences with flow. Flow was often related to the language being learned rather than language learning generally, and this was related to the accessibility of a language in different ways. DL is a clear example of how flow can be dependent on specific languages. DL found it difficult to experience flow with Korean:

> *DL: There are some activities where I think I do achieve flow … I've found it difficult to really achieve flow in Korean but in French and Spanish I feel like I can get there.*

With DL, as outlined in the SRL section, it seems that achieving flow is related to interest, which is associated with a multitude of factors, as well as an amount of ease in understanding (which itself could be a condition for allowing learning to be interesting). Comparing it to Csikszentmihalyi's flow scale (see Fig. 4.1) it might mean that his challenge and skill levels never match:

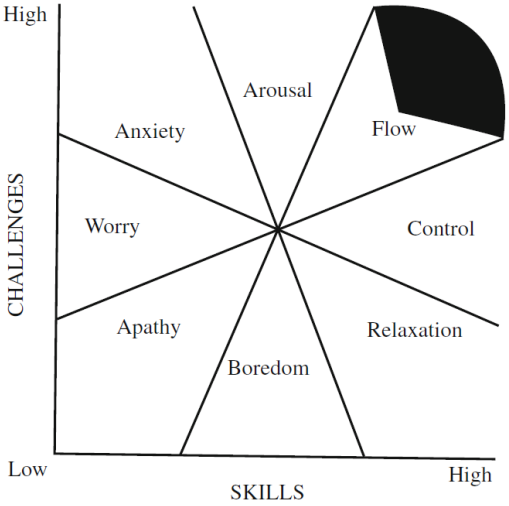

Figure 4-1 -- Quality of experience as a function of the relation between challenges and skills (*Csíkszentmihályi, 2014b)*

> *DL: French and Spanish are similar enough to English that it's easier … to guess words from context when I'm reading or … I'm listening it's easier for me to ask questions … and understand the answer the first time around so … easier to feel … it's easier to enjoy … what I'm doing than I've ever found it to be … with Korean*

For DL, Spanish and French have a difficulty level which can be overcome through, in this case, vocabulary similarity, while Korean does not share this quality, putting flow out of the reach.

AS also expressed difficulties in achieving flow with Korean. For AS the difficulty was associated with the content of the lessons found in her Korean class and textbook:

> *AS: The topic needs to be interesting. The thing was when I was learning Korean in their textbook a lot of things were only about Korea, right? … Some things were not interesting for me … and I felt that I don't need to learn this. It was not about language but … that this is not interesting. When I was learning German, the text was so interesting that I wanted to read it and that meant that learning was more fun because they chose amazing texts. … it was not just that I was learning a language, but I was learning something more. I felt like I want to read … interest in me developed much faster … so I like to read that text too. You know the text in the books is so interesting it's not about just language learning … so I wanted to read it more and more but here* [in Korea] *… I lost a lot of interest because many times I felt like I don't want to know*

> *this … why should we know this? … all the things that we learned in that book I felt like it was only applied to Korea. I felt like I don't want to know this. It's not standard information or general information … but if they had for example an encyclopedia word in Korean … and they had put those kind of things in our books I would be like wow that's informative I want to know this so it's not just language learning I'm learning lots of additional information which is general.*

The concentration that is necessary to achieve flow is, for AS, out of reach because she is not able to focus on materials which she finds boring. AS might be closer to flow with German but that is not certain:

> *AS: yeah. I understand this* [flow]*. But I couldn't relate...*

AS expresses an understanding of flow but cannot see it in her own language learning.

TY expressed that, while noticeable at different times, he experienced flow when learning specific aspects of languages:

> *TY: … when I was learning Chinese characters* [sic., kanji] *… it was something a little special because I just actually did love them … even within the last couple of weeks I've had a moment where … Oh, where'd that hour go?*

TY, then, has clearly experienced a loss of the sense of time, which is descriptive of a flow state, opening the possibility that he has experienced it.

DM also expressed a tendency towards flow that was based on specific languages or on a specific aspect of a language:

> *DM: It feels really really good especially actually it also depends on the language … if I'm doing something like …* hanja [Korean Chinese characters] *then it feels even better.*

While it is not clear that this example is a flow experience, it is, for DM, as with most of his descriptions of studying, obvious that he has no difficulty with maintaining interest when learning a language. There is more evidence which indicates that DM achieves flow when he describes a deeper sensation:

> *DM: It's a real endorphin rush … that might be why I … can … stand … living in* [a western Canadian city].

That is, for DM his studying is engrossing enough that it mitigates the negative effect of living in an environment that he is not fond of. DM also shows a clear understanding of how he maintains flow:

> *DM: And about the zone itself … it really does feel like … exercise … there's a lot of … convincing your brain that the tiredness is worth it … and … when I read for long periods of time I start to … do this* [moves closer to the screen] *… read it like that and … stare at the book more intently …*

Although mentioned in an answer about flow, this description of how he continues to focus could also be an example of grit and SRL, showing the overlap between these constructs.

4.3.6 Expertise and expert performance

Expertise and expert performance was the most difficult area to gather data on. Research in this field lends itself to a study conducted over time to examine not only the hours of practice, but the quality of those hours. Nevertheless, indications are that there was a substantial difference in the quantity and quality of the time spent learning additional languages between the less accomplished and the more accomplished language learners in the interview portion of the data collection.

4.3.6.1 Time

Quantity of hours is essential to the development of expertise (Ericsson, 2016). Among the interviewees the hours dedicated to language learning fell along a spectrum: DM has devoted, and continues to devote, huge amounts of time to language learning, but DL, AS, and TY have also devoted large amounts of time. What sets DM apart is the continued devotion of hours, whereas DL, AS, and TY are more sporadic and, upon reaching goals, their time drops off

precipitously. EM and AL, while giving some time, do not dedicate meaningful amounts of it to learning.

For EM and AL time seemed randomly allocated to learning and, as mentioned previously in the SRL section, quality was lacking. AS, DL, and TY all showed periods when a lot of time was spent learning and practicing, although these were typically only sustained until specific goals were reached. Only DM, the hyperpolyglot, continuously spent time learning.

EM related his experience while taking language courses:

> *EM: Class time is eight hours and I think I probably I don't do a huge amount after that. It's probably at least three or four hours on top of that.*
>
> *DH: So about 12 hours a week? … And that's been for the last five weeks?*
>
> *EM: Yeah or anytime I've had that kind of class and I've had homework or stuff to do. So, when I was studying at YBM* [a private language school in Korea] *it was kind of similar. A little bit less. It was up to six. Some weeks it was four.*

EM also indicated that he spent some time studying outside of class, but not a substantial amount. Additionally, periods of studying language were sporadic, indicating bursts of study punctuating long periods of no meaningful time being given to learning. Hours spent learning are, therefore, quite low when averaged over longer periods.

AL indicated that time spent dedicated to learning a language, while sometimes high, typically was not, mirroring the sporadic efforts of EM. In describing the time which she dedicated to improving both her Korean and her Japanese she estimates that the number is quite low:

> *AL: it depends on the month, but I'd say maybe I've spent a total of two hours … for the whole month*

In the past, however, while difficult to put a number on, she indicates more dedication given to Japanese:

AL: I watched anime almost every day I think and the game [a Japanese typing game] *I probably played every other day.*

So, for AL time was spent with the target language but this time was not sustained, clearly showing a lack of the hours necessary to noticeably improve her language ability.

AS seemed to give more time to her learning than EM or AL. She indicated that while she had recently reduced her time commitment to Korean she had started out with more:

AS: For the first four levels [of the KIIP course] *I studied … really hard. Whatever time we spent in the class like three hours in the evening. … Monday Wednesday Friday … And then … I would study when I was not working I would study the next day in the morning to afternoon … And when I was working* [I would study] *complete Saturday and Sunday. From morning to afternoon.*

Although the hours AS dedicated to Korean tapered off as she got nearer the end of the program, the time she had spent was not inconsequential. However, the hours she spent on German were much more:

AS: German … I learned it for one year from January to December and it was like weekdays Monday to Friday. Five hours each…

DH: Five hours every day?

AS: every day

DH: So … 1250 hours. Did you do homework outside of the class?

AS: Yes, of course.

DH: About how many hours did do you?

AS: Probably three to four hours

DH: Three to four additional hours on top of that so quite a substantial amount probably over 2000 hours.

AS: Yeah probably. I did study well.

2000 hours over the course of one year is quite impressive and, while it is impossible to give precise numbers as to how many hours it would take an individual to learn a language (see the quality/quantity description in the Discussion section, 5.6), comparing AS's 2000 hours of German to Language

Testing International's estimates, in which proficiency for a group IV language (the most difficult languages to learn) is reported to require between 2400 and 2760 hours of classroom time ("How long does it take," n.d.). AS was clearly putting in sufficient time to achieve a high level of German.

DL describes the amount of time spent learning languages as varied. There are times when he spent hours a day and times when he did not study or practice at all:

> *DL: Well right now it's zero … but in the past … it's gone … to as much as 10 hours a day.*

The times that DL spent studying or practicing tended to be during periods of immersion, which allowed him to get so much practice:

> *DL: These were times when I was … studying full-time and living in a homestay and meeting people that spoke the language this was my experience about France and in Costa Rica and Nicaragua where … I would wake up I would read the newspaper in French or Spanish I would … have … my host family to talk to I would go to class which would be immersive and then I would hang out afterwards either with locals or … other students … who spoke the language even if they were from my own country … I was in class for four hours a day and then … we would have very long dinners where we need an hour and a half two hours … plus add in the reading … and homework time … when I would have to spend writing papers that would easily go up to eight hours on a typical weekday and if I went out if I hit the bars afterwards then that … could get up to ten or twelve hours where I'm … using French and … it was similar … in Nicaragua. It was probably more … in Nicaragua because … one person I knew that spoke English in the entire town and … she was kind of boring … so I spent most of my time with my host family … she had a lot of friends like all these poets and former revolutionaries that … were a lot of fun to hang out with and talk with.*

Overall, DL's hours devoted to studying fluctuate from periods of many hours a day to periods of no hours a day. This is not an uncommon pattern.

TY, like DL, has varying amounts of hours dedicated to his language learning. Retrospectively he found it difficult to be specific with those hours, but he provided an estimate:

> *TY: I really can't put a number on it … whenever people ask I say when I was six I learned how to count from one to ten in Spanish … and if that's the number then it must have been thousands … of hours because I learned Spanish all through school and then all through university. I learned Japanese for four years and if you include merely speaking a second language as practice then thousands and thousands of hours because I speak Korean every day*

Like DL and AS, TY does not constantly maintain practice, unless it is considered that his everyday Korean interaction is practice. Also, as with other participants, the accomplishment of a goal affects the time devoted to learning a language:

> *TY: When I wanted to get level 6 on the TOPIK test … I sat down, and I read two articles in Korean in news articles every day and I listened to like comedy shows every day until I took the test and I blasted through the test got level 6 and I never did it again. So that's it for me.*

TY, then, dedicated hours to the study of Korean regularly, but upon achieving his goal the hours and dedication dropped away.

The hyperpolyglot shows a different pattern of dedication. DM continuously devotes time to language learning and reaching goals in one language does not translate to a reduction in hours dedicated to learning but, rather, those hours move to another language. His hours, while affected by the other events in his life, are adjusted to match the time he has available:

> *DM: When I was working full-time… I had managed to get in two* [hours a day] *and then on weekends of course it goes up to like five or six.*
>
> *…*
>
> *DM: Recently just … about an hour ideally when I have … enough time and … if I'm living in the* [target-language] *country I want to live in and then about six hours.*
>
> *…*
>
> *DM: … doing what I did in 2002* [living in Korea] *then it's every … waking moment. Back then my schedule was I'd wake up about nine or ten and then I'd turn on Arirang* [a television station] *and they would have those you know … those subtitled dramas in the morning? … I'd watch one of them … from about I think ten to eleven … buy a* [Korean] *newspaper to go to the Ediya or a Starbucks and then read that and then explore for a*

> *bit and then afternoon do some more reading and in the evening usually I would meet* [Korean] *friends … in the … Starbucks from like two to eight.*

The number of hours DM devotes to languages is impressive in the context of working full time, but when the opportunity is favorable, living in the target-language environment and not having a full-time job, the hours devoted to language learning are incredible. The description above has one hour spent watching a target-language television show, six hours studying the language in a coffee shop, and additional hours spent using the target language afterwards. This is very similar to the hours which DL dedicated to both French and Spanish, but the difference is an important one: DL reduces to the point of elimination the hours dedicated to language learning when goals are met or when he is not in a specific environment, while DM continues to devote available time to learning.

DM also seems to have the strongest grasp of time among the interviewees. His choice to transcribe German, as noted in the SRL section, was based on an analysis of the time he had available, and he accurately judged how many hours it would take. In describing an interaction with his boss, who was surprised that DM did not speak Vietnamese, DM offhandedly gives the specific number of hours that it would take him to learn the language:

> *DM: She* [his boss] *came along and asked me what this … phrase in Vietnamese means and I said I've never studied Vietnamese I don't know a single word of it. She said, 'What? You don't know Vietnamese?' and just walked away. So, I could have put in … four thousand hours to learn Vietnamese and she would have just … not seen any difference at all.*

This is an indication that DM is very aware of the time commitments necessary to learn a language.

4.3.6.2 Deliberate practice

Ericsson divides practice into four categories of practice: naïve, purposeful, proto-deliberate, and deliberate (Ericsson & Pool, 2016). In the context of the interview it proved difficult to clearly differentiate categories. That is, isolating proto-deliberate from deliberate practice, or even purposeful practice, could not be done in the interview situation because shades of difference are not obvious—this results from not only the difficulty of separating discrete points on the spectrum of practice, but also from shortcomings in the interview stemming from, in particular, the difficulty of classifying different types of practice into these discrete types. Nevertheless, there is a difference in the stated goals surrounding the different types of practice as well as the amount of consideration put into the efficacy of an approach to practice. Additionally, DM, the hyperpolyglot, expressed layers of nuance in his practice which, while echoed at times, was not sustained by the other participants.

EM did not get deeply into his study and practice methods. Neither could he elaborate on his reasons for choosing or adapting methods and approaches. Overall, his answers showed a lack of meticulousness in language learning and this can be seen in a segment of his interview which was considered in 4.2.3:

> *EM: I'd say for me it's about boredom or something is effective for a while but once … I've been doing it for a while it gets boring. Or, I want to have some new thing. I've tried various methods … like vocabulary. Just basic flashcards or making pictures to go with vocabulary so I'll do that for a little bit, but I wouldn't keep it up… I don't have one way which works … just stick to it … But now I need something new … maybe just tweaking. Like for example I used to use … ANKI for flashcards. Now I use Quizlet. Just changing to a slightly new format is enough to make it less tedious… I've done language exchanges… I've done that trying to get speaking practice… I don't really try and learn from Korean movies or television shows I've done little bits like I've looked at some scripts. I've looked at some lyrics for …music occasionally.*

This type of consideration of practice and study time shows a hazy conceptualization of a system—a half-hearted stab using one method before changing to another method, and an unstructured attempt at different ways of getting speaking and listening practice.

Like EM, AL also does not seem clear on how to practice or why to practice in a specific way. Her lack of depth in describing her approach makes this clear, and was in 4.3.2.1 in relation to the forethought stage of SRL:

> *AL: … I'm not delving too much into a language… learning about it. … I'm just focusing too much about surviving or getting through the task that … needs to be done whether it be talking to the doctor or, yeah…*
>
> *DH: So, you define your goals for practice study sessions?*
>
> *AL: Oh, my goal would be to complete one page yeah so that's my goal … But I don't know what the page would be about. What the unit would be about beforehand so I'm not sure what the goal is exactly but yeah… But my goal… well I guess when I do that one page of the book each time I my goal is to understand every word that is on the page…*

Using the language is, for AL, a functional event rather than one which is used for learning; that is, her goal is to get through a communicative event rather than to learn from the process. Her goal of understanding every word on a page is, seemingly, a retrospective goal imposed during the interview rather than a goal which AL had while studying, which is seen in the excerpt above when she says "yeah" and "I guess"—both of which, contextually, reflected a previously unconsidered notion.

An important aspect of deliberate practice is challenging oneself by attempting tasks which are above one's present ability level. AL's description of this is interesting:

> *DH: And how do you push outside your comfort zone?*
>
> *AL: … just being able to sit down for one hour and work on the book is the getting out of my comfort zone.*

The most important part of this description is that AL's comfort zone is not a comfort zone related to language ability but to a comfort zone of time. That is, rather than using an hour to challenge herself to achieve or learn some aspect of a language she is, rather, merely pushing herself on time alone and not on skills—this limited quantity matched with limited quality is naïve practice in which learning is just going through the motions.

AS describes practice in a little more detail than AL or EM but her focus is on goals and motivation, not on techniques. For AS, quality of practice seems more related to learning vocabulary, for which she does not elucidate on the mechanics, and using exams to act as motivation:

> *AS: I think learning … to memorize… helps. that is a good learning practice.*
>
> *DH: So, I'll bring this a little bit further. How do you learn vocabulary? You've mentioned listening and exposure.*
>
> *AS: When I'm studying for an exam … there are two kinds of processes … natural and … unnatural where we're of course trying to memorize … now the natural process … may not be a faster process. It's slow. It's natural …. Let's say I'm talking to this person. I will talk to another person the next day … so … it takes many days … years but it's very effective… another one is when you have an exam in two months you cannot use the natural way up to learn. you know you have a limited … to finish learning … the time you have to mug up. Have to memorize … so you make your brain … think it's a like computer and then you start feeding it all the words like a hundred and fifty, two thousand, five thousand. … and it's too much for your brain … so you're learning it unnaturally … just because you want to clear that exam.*

Her practice in the first case, learning 'naturally,' seems to move beyond naïve practice in that she is looking at continuity and has a consideration that what is learned one day will be reinforced the next. The second case, the 'unnatural' process, has the indication of involving a more intense process but it is not clear that the process is deliberate or even proto-deliberate.

DL expressed that that high-quality practice is based on being challenged, likening it to the zone of proximal development:

> *DL: I guess finding something that is challenging enough … and engaging enough … I feel like I'm actually absorbing.*
>
> *DH: What is challenging enough?*
>
> *DL: Where I'm actually learning … new vocabulary … expanding what I know.*
>
> *DH: So, if your level is here* [gesturing with my hands] *you're shooting where?*
>
> *DL: … just a little bit higher what in education they call … a zone of proximal development where …* [I] *might need some help.*

This description could be proto-deliberate or deliberate practice. First, there is evidence of pushing outside the comfort zone to a level just a little above his ability, leading to greater achievement. Next, Ericsson & Pool (2016) suggest that deliberate practice requires outside coaching to help overcome this ability gap, and DL points out that his effort "might need some help."

Both TY and DM give more detail about the way they practice as well as the reasons behind the practice. DM rarely hesitated when answering questions, giving the impression that he had already thought about the areas being discussed. TY, while prone to more cogitation, gave full answers which sometimes seemed self-revelatory as he had not previously considered them but, nevertheless, showed an understanding of the purposes with which he approached studying and learning:

> *TY: I didn't expect … this is hilarious* [a Korean television show called 'Gag Concert'] *… and I did quickly realize that it was a fabulous form of listening practice … it's good practice it's harder than the test listening so I'm certain that if I listen to one every day … I'll pass the test but to be clear when I passed the test I … abandoned that habit and have never picked it up again so the goal was essential but at the same time the choice of materials was informed by enjoyment and a recognition of the use of those materials on my part*

The elements of proto-deliberate or deliberate practice are seen in TY's answer. First, he was working towards a specific achievement goal (passing the exam), approaching it systematically (every day), and choosing materials relevant to the goal.

TY also shows that he spent time practicing and did well in execution:

> *TY: When I look back there are things I did which in a cold moment like now when I'm not inspired to do anything I'm shocked at how I did it … when I'd only been in Korea a year I was memorizing … songs and I would I remember vaguely that I'd just go line by line I would just memorize every line and then every word I didn't know I would take it aside and write the English and memorize it and by the end I would know not only the whole song I would also know the meaning of every word in it and then I would be able to use those … and obviously there's always a sense of joy that comes from learning what really sticks with me more than a feeling can because it kind of goes away is the enjoyment of singing those songs at* noraebang [Korean-style karaoke].

This type of practice has many elements of high-quality practice and clearly shows the concept of practice and performance. Ericsson says that the majority of time spent in developing a skill is spent in practice and not performance. While it is that case that often practice and performance cannot be separated in language learning, as is clear with some of the answers given by the interviewees in this study, in this case learning songs culminates in the performance of singing those songs.

DM, like TY, uses authentic materials such as television programs and songs as he learns a language. His treatment of these materials and his methods clearly show deliberate practice in many ways. This can be seen in a segment previously considered:

> *DM: A perfect time to … transcribe* Damien*, the German book… that I later translated since I had the audio file... it was six hours long and so what I did was I … used* Audacity*… So I use that to … select … five seconds at a time and you just hit the spacebar with your left hand … write it with your right and I managed to do it all within three weeks… and then … try your best and then sometimes you don't know what … it said and*

> *then just open up the book and you check and you … use your hand to make sure you don't look ahead.*
>
> *DH: So, your German is at a B2 level?*
>
> *DM: Yeah. I've never been to Germany but … I've talked to Germans a lot now because there's a … an event here called* Stammtisch - *where you get together and you talk German and I … also took, when I was doing the French degree, … I managed, or I was able to take three German classes at the same time.*

For German, DM found both a pdf and an audio file and got instant feedback by checking his transcription with the original. Even the very small explanation of using his hand to block the text and thereby avoid looking ahead indicates a focus on getting maximum benefit from the activity and not 'cheating' by simply looking at the answer. Additionally, he found opportunities to practice speaking and took three German classes simultaneously for additional support, enlisting what, possibly, Ericsson would consider coaches.

DM also describes some of the authentic materials that he used for studying. In the previous section on hours a description is given of the amount of time with DM spent learning Korean. What is apparent in his description is that quality of his practice—it is directed and specific. DM also thinks this about his own approach:

> *DM: I think my quality is top-notch because … what I do is I find as interesting content as I can and I'm learning that at the same time so … I'll find like a book that I really want to know or a subject that I want to learn … It can be anything it could be history or programming or just … a book that that I found a translation of that's … originally in English and … I use that…*

The first indication of DM's 'top-notch' quality is that, like AS stated earlier in her description of motivation, he finds content which lends itself to being interesting, thus maintaining his motivation. This is similar to the importance that AS placed on interesting content. Next, unlike some language learners, he does not avoid difficult learning points for which others would feel awkward but, rather, he

appreciates these points and focuses on them, indicating that he is targeting areas for improvement.

Another important aspect of expertise and expert performance, according to Ericsson, is the need for coaches and teachers, people who, hypothetically, bring quality to the time being spent practicing. While coaches and teachers are not an assurance of practice being deliberate, Ericsson indicates that they are typically required, at least before an individual reaches a high enough level to self-monitor (Ericsson, 2008). Interestingly, at least on a cursory level, this seems to not be true, or to not be *completely* true, for the interviewees in this study. All the interviewees in this study have studied languages in the traditional environment of the language classroom, but six of the interviewees, DL, AS, AL, and EM, seemed to have relied primarily on these traditional environments for most of their language studying, while DM and TY seemed not to need, or even desire, much formal coaching. In the case of the hyperpolyglot DM, this is particularly obvious.

TY, while having studied languages in the classroom, is emphatic that he required no tutor, coach, or teacher for Korean and likely could have learned other languages in their absence as well:

> *I always like to say I never took a class* [for Korean] *… but my Korean is still better than almost anyone I know … I didn't need a class or a teacher in this case. Obviously, I studied Spanish in class but I didn't need a teacher and I didn't need a curriculum and I didn't need anyone to motivate me*

Based on his success in learning Korean this does not seem to be incorrect, indicating the possibility that perhaps a coach can add or aid language learning but is not a necessary condition.

DM is also clear that he does not require coaching. In DM's case, he has taken formal classes for some languages, such as German and French, but the

German classes were a source of practice and his French degree was a degree of convenience (he needed a university degree).

> *One day … before I made the decision to go to university, I was … in Vancouver for a month to look for work and … one company after I came back to* [a western Canadian city] *said … we need somebody that speaks German and … we've got this Austrian lady and she's going to talk to you and … I said that sounds fine and then I went on Italki and … I found somebody to talk to in German for … an hour … just to kind of warm myself up.*

So, while they are not a large part of his learning regimen, DM does make use of tutors. Nevertheless, they seem more of a resource rather than coaches.

Both TY and DM explain different ways in which they get feedback and it is typically not from a coach or a teacher in the formal sense but, rather, from other speakers of the target language. TY, for example, related a story which shows this clearly: when at work he asked for help, but he used a non-standard Korean phrase, upon which his co-worker corrected him, leading to his more accurate usage afterwards. He mentioned that it was by 'putting himself out there,' by taking a chance of being wrong, and using corrections given by the people he is interacting with, that allowed him to improve. This does cause him to step back on his earlier assertion that he did not need teachers:

> *I'd be lying if I said that nobody taught me … every interaction is a form of teaching a form of learning and of course there were people who in a given moment would have corrected me so … I'm not going to say, because it doesn't even make sense, that I learned Korean alone it's just not logical. You can't learn a language alone … it's all about interaction*

It might be true that he had no formal teacher, but clearly TY can see that he did receive feedback which translated into a kind of instruction.

4.3.7 Emergent themes

In addition to the predetermined areas covered by the interviews there were additional themes which emerged. Some of these, such as motivation and goals, were notable because they were so evident in the answers of the

interviewees. Others, such as self-image, habits, and satisficing, were not always as lucidly expressed, but were evident, intertwined with other ideas such as self-image and motivation. Due to space considerations not all these themes can be discussed; motivation, and self-image/identity were chosen for discussion as they seemed to have a strong influence on language learning.

4.3.7.1 Motivation

Although partially covered in the self-regulation section of this report, motivation warrants a separate discussion as it was often mentioned by the interviewees and is perhaps the most pervasive spontaneous feature of their answers. Different types of motivation, both intrinsic and extrinsic, were described, as well as increasing and waning motivation; and a lack of motivation was attributed to not developing language skills to a high level.

AL largely attributes her lack of progress in learning languages to a lack of motivation:

> *AL: I don't really have motivation to learn Korean. But because if I did I would have mastered it by now.*

Her belief, then, is that motivation, or perhaps intrinsic motivation, is key, and this is apparent in her reasoning for her lack of success with Japanese:

> *AL: I only had to take three courses of Japanese to get that requirement … I did like it because it was a personal motivation, intrinsic, but then once I got to university … it was a different way of learning so it kind of it was difficult to… it was hard to adjust.*

Clearly, for AL, intrinsic motivation is of primary importance.

AS mentioned motivation more than any other interviewee, relating it to language learning throughout the interview. She strongly emphasized that for her it is the most important factor:

> *AS: I think basically it's all about motivation … I need motivation to learn otherwise if I don't see motivation I cannot learn.*

For AS it was clear that she was talking about both intrinsic and extrinsic motivation, sometimes together and sometimes separately:

> *AS: You need to be honest with yourself when you're practicing you need to have that motivation. If you have no motivation forget about it. So, motivation and being honest with yourself… That fire within you. You need to have fire within you.*

Despite describing it as "within," it is not clear if 'fire' refers to extrinsic or intrinsic motivation, and in conjunction with her earlier comments about using exams as external motivation and interesting materials being related to internal motivation, it could easily be both.

DL also mentioned motivation several times and states that language learning relies on motivation as its primary impetus:

> *DL: I think motivation is the number one factor in determining whether or not … someone learns a language … it's not the how it's the why having a reason that makes someone want to put in the effort … for me at the beginning of trying to study Korean it was it was intellectual curiosity which was well reinforced by living here and having it making life easier and helped me meet people.*

For DL then, motivation is related to both the intellectual aspects of learning (intrinsic) as well as the social (extrinsic). According to DL, part of his failure to continue to improve his Korean was his lack of a Korean social life and, hence, the lack of motivational impetus from this sphere:

> *DL: I came back* [to Korea] *with a Canadian girlfriend who I eventually married and we had no reason to speak Korean at home it was difficult to form a social life in Korean with a wife who did not speak Korean and who was not interested in learning.*

This shows that motivation might be influenced by others in a complex way: getting married to a person who had no interest in the language effectively blocked DL.

TY discussed motivation in various ways including waxing and waning, maintenance, and situational motivation (living in the target-language country). In many ways he seems to have a Machiavellian motivation in that, while he does not dislike, for example, Korean culture, his motivation to learn was strengthened as a reaction to being discouraged to learn by his co-workers:

> *TY: That changed to become a desire to learn Korean specifically and then that changed to a desire to prove everyone wrong that I couldn't speak it … I had the desire to learn any language which predated any connection* [to the Korean language] *and I couldn't hate my co-teachers enough to want to prove them wrong until I met them right so … this is how my state of mind which clearly I do have a certain degree of passion but also bitterness no doubt about it a lot of bitterness going on.*

This reaction to being discouraged to *not* learn Korean can be example of how external motivation can stir up internal motivation—TY had an internal desire to learn Korean, but the big kick came from external forces.

DM's motivation is clear throughout his interview and is largely intrinsic. His motivation is often linked to specific languages:

> *DM: There are languages that I have a low motivation for that I haven't really gotten that deep into … Because you always you know you're going to start out with the languages you like the most and then eventually you start to run out of places that you think are pretty cool so there's some languages that I can't really dedicate myself.*

This is, ironically in that it comes from this study's only hyperpolyglot, the simplest view of motivation among the interviewees—DM learns languages because he either likes a particular language or he likes the culture of the language, showing a clear intrinsic motivation. His passion is clear:

> *DM: It takes … a lot of time* [learning a language] *and after you're done … you'll have … a second self and you might enjoy that you might not … if you're interested in in creating that second self then it's definitely worth it* [language learning] *but when you're … done you can't just be like the same person plus you know one more language you're actually something else so if you're if you're curious about that it's definitely … a journey you should undertake… And if you keep that focus in mind then it then it makes it way more interesting than just thinking … I'm learning*

> *I'm learning French or whatever. … you're creating this new person inside yourself and it's really fun.*

DM's motivation, as uncomplicated as it is at the base, also delves into self-image, detailed in the next section.

4.3.7.2 Image and identity

Image and identity arose as themes from some of the interviewees, commonly linked with motivation. For some this came in the form of social recognition or for being known as a person who is good with languages or a person who can easily learn languages.

DL had a reputation in high school as being 'the guy' who was good at languages:

> *DL: As the guy … that was cool … it was nice to be known for being good at something* [learning languages] *I was known in high school for a lot of things but that … was one of the ones I was actually proud of.*

DL's description hearkens back to Dale Carnegie's classic book, *How to Win Friends and Influence People,* in which Carnegie says, "Give the other person a fine reputation to live up to" (p. 252) DL's self-image was of a person who is good at learning languages and this worked not only to define how he saw himself but also motivationally affected his actions. TY also has a self-image as a language learner, and he expresses that he grew into this identity:

> *TY: Of course, you do settle into this identity as a language learner so after that I guess it just becomes natural.*

There is some possibility that this self-image has moved into their personal histories in that neither DL nor TY are actively pursuing languages. Nevertheless, both DL and TY see themselves as good at learning languages.

Of all the interviewees, DM has the most complete view of the relationship between language learning and identity, which he uses as both motivation and as visualization for self-development:

> *DM: I know maybe this isn't the proper answer, but I always have a view … there's me and then there's … a second me that's kind of … better in every way and then I … see him judging me a lot … but also hoping … for me at the same time … cheering me on… yeah trying to get better trying to be more … perfect.*

This is not only a view of himself in the present, a person who is constantly achieving success in learning languages, this is a view for long-term self-development. DM's self-identity is of a person who is constantly getting better. This is most apparent in his language learning, but DM also mentioned that he is learning to play the piano, approaching his practice in a similar manner to his language learning, and is also well-read in geopolitics, world history, and paleontology.

5 Discussion

The purpose of this research was to consider the relationships, through the lens of complex systems, of the constructs of SRL, mindset, flow, grit, and expertise and expert performance to attainment in multiple language ability inclusive of the high levels of facility found with hyperpolyglots. The complexity perspective is increasingly being used in the mainstream of inquiry into the understanding of language learning, and the present study adds to this evolution.

Various psychometric tests were given to participants: SRL, mindset, flow, and grit were measured using instruments which have been determined in other studies to be valid and reliable. Additionally, interviews were given and subsequently analyzed to determine how these constructs were seen by and manifest in individual learners as well as to uncover additional areas for consideration; semi-structured interviews were conducted, recorded, and coded thematically. Finally, interrelationships between the different areas were considered based on similarities between measures and points of comparison with interview findings.

Although traditional statistical measures were used, it must be emphasized that these measures are not considered definitive because the nature of complex systems is that monotonic relationships, linear relationships between variables, are not expected. Additionally, because this study does not have the dimension of time, the evolving nature of a complex system cannot be examined—we can only see a slice of the system at a specific temporal point and there is little reason to consider this slice a constant state while there are

good reasons to assume that the states preceding and following are different. Also, a relationship with language abilities and one of the factors, no matter how strong, is not necessary for high levels of language attainment over the trajectory of learning as a factor could be required for only specific point(s) in the trajectory, could be necessarily absent, could be necessarily negatively associated with success, or could vacillate between a strong and weak effect size at different points in time.

5.1 Relation between fields and attainment

What, if any, correlation exists between second language attainment of the fields covered in this research?

H_{01}: There will be correlations with all fields and levels of second language attainment.

This hypothesis is rejected. Although there were weak and very weak positive relationships in the initial treatment of the data, not all were significant. Grit was divided into its factors of consistency of interest and consistency of effort (explained in section 5.4), and it was found that the consistency of interest had a weaker relationship than the overall grit score, but the consistency of effort factor became significant. That is, consistency of effort seemed to have a stronger relationship with multiple language acquisition.

The relatively weak effect of the factors is unexpected yet not surprising. The approach of this research was not to determine which of the factors under consideration could be the most likely candidate to explain success and to minimize the importance of the other factors but, rather, to consider fields as relational parts of a whole. The statistical analysis method used, Spearman's rho, is used to analyze monotonic relationships between variables, but complex systems are not monotonic. Nevertheless, it was felt that positive correlations

would be more plausible factors for language learning success than negative correlations.

5.2 Self-regulated learning

H_{01}a: *Self-regulated learning will correlate strongly with all other areas.*

The hypothesis is rejected. SRL showed a weak relationship with mindset, a strong relationship with grit (a moderate relationship with the consistency of interest factor and a strong relationship with the consistency of effort factor), and a moderate relationship with flow. Although SRL showed the biggest effect size of all factors with levels of second language success, the correlation was very weak in the B1 and up condition and weak in the B2 and up condition.

Although surprising, there are possible explanations why SRL, typically a robust indicator of learning success, is not as strong in this study as originally hypothesized. Primarily, of course, as part of a complex system there is no need for SRL to have a directly observable strong effect. There could, for example, be a sensitive dependence on initial conditions where SRL need only have an influence at a specific period; a period which shapes future events but becomes no longer necessary having already set a series of developments into motion. For example, DM had a friend who both knew kanji and was willing to trade kanji flashcards for Egyptian hieroglyphic flashcards. The self-regulation of DM was not only making the initial flashcards, but also using those to barter for more learning materials. If DM did not have the resources he had (a friend who could offer him kanji cards and a textbook with hieroglyphics), would his interest in languages have been aroused? Considering that French was part of the school curriculum and that he was not interested in it, perhaps not. As far as the initial seed of interest, self-regulation was present at the right time.

This would be consistent with complex systems: “Because systems are constantly in flow, they will show variation, which makes them sensitive to specific input at a given point in time and some other input at another point in time” (De Bot et al., 2007, p. 8). This is speculative, but it reflects an issue with the definition of SRL: is it an event or is it an aptitude?

Winne and Perry (2000) state that SRL can be conceptualized as an event and an aptitude, but the SSRQ, as a questionnaire, provides a measure of SRL as an aptitude. The conceptualization of SRL in this research was, therefore, only a consideration of aptitude, which could have worked detrimentally against finding an explanation though the consideration of SRL as an event, or events, which could have been points of divergence in the language-learning process. This is an issue, as mentioned before, with the absence of change over time as a consideration.

The qualitative data seemed to support the quantitative findings with the six participants in the interviews. That is, the participants with the least successful outcomes, EM and AL, showed little tendency to being self-regulated, describing a desultory approach to learning languages, while the more successful learners, in particular the hyperpolyglot DM, showed more effort and concern about creating a facilitative learning environment and techniques.

5.3 Mindset

H_{01}b: *Mindset will correlate with all fields. A fixed mindset will be more apparent in subjects who speak one or two languages and a growth mindset will be more apparent in subjects who speak a greater number of languages.*

The hypothesis is rejected. The correlation is very weak with language ability measured at both the B1 and up and the B2 and up levels, very weak with flow, and shows a weak relationship with SRL and grit.

Mindset shares the same issue with SRL. While the Mindset Instrument has been designed as an instrument to measure a general trait, it seems to typically be studied with an academic bent, and much of the research looks at the effects of mindset in school settings, or at least reflects values in which intelligence is often considered in relation to educational and academic success. The TIS has the word 'intelligence' in every item, so it is possible that respondents are evaluating themselves in relation to their academic lives to the exclusion of their everyday lives. For example, when considering an item a respondent might reflect on past academic success due to associations with the word 'intelligence,' and the subsequent response could show a fixed mindset, while in their everyday lives they are quite adept at learning to play musical instruments, welding, or debating the finer points of the *Star Wars* movies, yet not consider these pursuits to come under the aegis of intelligence.

The idea of a domain-specific mindset is not new. Dweck, Chiu, and Hong (1995) express that although some people have a general implicit theory model which affects their overall outlook, it is also true that people can have domain-specific mindsets. This idea was carried into a consideration of a language-learning mindset by Lou and Noels (2017), who stated that "it is reasonable to think that language mindsets are distinct from mindsets in other academic and social domains" (p. 215). In their model, Lou and Noels add additional elements to the core of the mindset framework: general language intelligence beliefs (GLB), second language aptitude beliefs (L2B), and age sensitivity beliefs about language learning (ASB). GLB, L2B, and ASB were used to create the Language Mindset Inventory (LMI). This instrument, being language learning focused, could elicit different data showing a different, possibly stronger, effect

size of mindset on learning additional languages but, as stated previously, the LMI was not published until after this research had begun.

The qualitative data was difficult to parse on this point. All the interviewees gave answers indicating that they saw the value of hard work. Among the more successful learners, TY indicated that perhaps talent is an issue for those who could not successfully learn a second language, but he also indicated that mindset is possibly malleable and, logically, mindset can affect learning a second language: “the obvious point is that if you believe you can't grow then you probably won't.”

5.4 Grit

H_{01}c: Grit will weakly relate to the other fields because it is apparent only in difficult situations and such situations will be equally distributed amongst all participants.

Grit showed a weak relationship with mindset and flow and a strong relationship with SRL. The weak correlation with mindset can be understood in much the same way as discussed in the mindset section: a growth mindset might facilitate grit but whether a person needs grit is more dependent on whether the person *undertakes* the effort, and less that they know they can be successful through effort. This idea is borne out by the subsequent treatment of grit, which was broken down into its factors: consistency of interest and consistency of effort.

For language attainment in the B1 and up condition, grit had the weakest correlation of all the factors measured. In the B2 and up condition, however, it showed a slightly stronger correlation than mindset. The hypothesis is rejected due to this slightly stronger relationship, indicating that grit is potentially more

important than originally conceived, but, nevertheless, it does not have a clear relationship with success in learning multiple languages.

The lack of a strong relationship between second-language success and grit can be understood in different ways. Duckworth and Gross (2014) suggest a framework in which grit can be viewed as part of a system of potentially competing goals for which, to support superordinate goals, modifications and positive reactions must be made with self-control. Grit, then, could be mediated by self-control, meaning that correlations between grit and second-language learning achievements will not be strong if the self-control condition is not met. Duckworth and Gross make the point that "some exceptional achievers are prodigiously gritty but succumb to temptations in domains other than their chosen life passion" (p. 1). This is an explanation of how a high grit score need not lead to success in a domain–people can be gritty, but it does not follow that they are pursuing excellence in a field.

Yamashita (2018) also found that there is not necessarily a strong relationship between grit and language learning. While Yamashita did find a relationship between second-language extensive reading and grit, he found that there was not a significant relationship between grit and Japanese language course grades (this assumes that course grades are correlated with language skills). He suggests different possibilities for this, including competition in terms of course loads and course prioritization, which is in line with Duckworth and Gross' idea of superordinate goals not being supported.

There is another issue which, perhaps, could color expectations—the possibility of non-random subjects being used in the original grit research. Farrington et al. (2012) make this point in their discussion of grit:

> Unfortunately, because these studies [the original grit studies] are focused on understanding variables that affect outstanding achievement among groups of high achievers, their findings cannot easily be generalized to broader populations. (p. 22)

It is possible that grit, then, is a factor which tends to be clearly seen only when examining a population of high achievers. While the present research does contain some high achievers, it does not have enough for statistical analysis, and hence, could explain why a strong relationship with grit is not apparent.

Another important point about grit which must also be considered is that it is possible, almost certain, that grit will not translate into achievement if it is driving unproductive actions. The hitting-one's-head-against-a-brick-wall effect can illustrate how grit might not, in itself, lead to success. If a person continuously undertakes the same futile actions, using the same futile strategies, gains will be minimal and possibly non-existent. As a sub-system grit would seem to rely on the support of other systems. If it were mediated by mindset and directed by SRL it is easy to see its value, but by itself it could lose its power.

Grit consists of two factors, consistency of interest and consistency of effort, and during the data analysis, due to the even weaker-than-expected correlation with grit and second language achievement, these factors were examined separately. This allowed for a consideration of the relative strength of the interactions on the system of second language learning. When separated, consistency of interest showed a much weaker relationship with second language learning achievements while consistency of effort showed a more robust relationship. In the context of this study, the explanatory power of grit was lessened because of the averaging of these two factors.

This relative strength of the grit factors has not previously been considered in second language acquisition (indeed, grit itself is only beginning to be

considered in the field), but this difference between the factors has been noted elsewhere. Wolters and Hussain (2015) have noted that consistency of effort was related to academic performance but not to consistency of interest. Also, they found that SRL was a mediator for consistency of effort, but not for consistency of interest. This is partially in line with the findings in this study in which the relationship was stronger between SRL and consistency of effort than with SRL and consistency of interest. To extend the head-against-a-brick-wall analogy mentioned above, SRL allows for the effort being undertaken to be made more effective though choices which equip a person with a means to either break through the wall or to step around it—in either case, directing their efforts towards effective actions.

Unlike with the quantitative scales, in the interview portion of this research grit seemed to match with levels of language learning success quite closely. The least accomplished learners, EM and AL, did not display grittiness in their responses. For both, language learning was not something that they pushed themselves to do. AS, DL, and TY on the other hand, did show grit, continually pushing themselves for at least a part of the language learning endeavors. DM, the hyperpolyglot, showed the most grit in that he never stops pushing.

5.4.1 Consistency of interest

Consistency of interest showed a negative correlation in the B1 and up condition, a very weak relationship in the B2 and up condition, a moderate relationship with SRL, and a weak relationship with flow. As mentioned above, just having an interest in learning a language need not translate into putting in or continuing the effort to learn that language. It is quite easy to imagine that the ability to maintain interest levels can be a mediating condition, but it is less clear

that maintaining interest is a required condition. How many people, for example, did not maintain interest in school and yet still managed to learn to read and do basic arithmetic (or even to complete a university degree)?

5.4.2 Consistency of effort

Consistency of effort was the biggest surprise in the data analysis. It showed a very weak correlation with languages in both language conditions, a weak relationship with mindset and flow, and a strong relationship with SRL. The difference between consistency of interest and consistency of effort are the primary point of interest and indicate that the relationship between grit and language learning, possibly, could be better served by considering its factors separately as their effect sizes are so different, and it seems that, on the surface, consistency of effort has a stronger relationship with all factors.

Acknowledging the possibility of hindsight bias, it seems obvious that consistency of effort would have a stronger relationship with language learning than consistency of interest. As outlined above, having an interest in learning a language need not translate into the undertaking of learning a language, meaning that effort unexerted remains in a state of potential. If potential energy is not converted to work, the amount of interest does not matter. Of course, interest could be considered a mediating factor, but it is not a necessary factor, as outlined in the consistency of interest section. Effort, however, with the present-day lack of direct-to-mind uploading technology, *is* a necessary condition. In a situation such as the EFL environment of Korea, where, anecdotally, English education is not an interesting endeavor for students, it could be that bulk of the value of grit as it relates to explaining the improvement of language ability is with the consistency of effort factor.

5.5 Flow

H_{01}d: Flow will correlate with all fields and be more apparent with the extreme of hyperpolyglottery.

Flow correlated with all fields showing a very weak relationship with mindset, a weak relationship with grit and with language abilities in both conditions; it showed a moderate relationship with SRL. As such, the hypothesis is rejected.

Flow was included in this research because it was felt that it could offer a way to differentiate deliberate practice from other practice, as deliberate practice was conceived of as practice which requires complete attention, and flow, by definition, is a state in which complete attention is being given. It was also thought that flow could act as a mediator on hours spent learning and practicing with hyperpolyglots, whose dedication to learning hints that the activity provides a large reward to the learner and is, perhaps, an autotelic endeavor.

While there is a relationship, flow does not seem to have as large an effect on language learning as envisioned. It could possibly be a mediating condition, but it would not appear to be a necessary condition. In the interview portion of the research it did seem that DM, the hyperpolyglot, was describing situations in which he was in flow during his learning sessions, but DL, AS, and DG also described situations which might have been flow or might have simply been interest or enjoyment. If flow were measured in milliliters, that is, if a person could be in ‘a little bit’ of flow, it might be illuminating to compare flow to the grit factor of consistency of interest, but flow is a condition in which all of a person’s attention is focused, or a state achieved after a tipping point has been reached, and it is difficult to tease out its contribution to learning in this research.

Although little research has been done on flow in the field of language learning there has been some recent movement. In particular, Ibrahim (2016) has looked at flow in relation to motivation and mentions its relationship to directed motivational currents (DMC). For Ibrahim, flow could be seen as a subsystem related to DMC which helps explain engagement in language learning through the process becoming "enjoyable for its own sake" (pp. 222-223). While Ibrahim's study does not consider hyperpolyglots, this hint of possible autotelic behavior is possibly a means of understanding their motivation. This does not, however, mean that flow and DMC are two faces of the same construct, as DMC provides a different view (see 5.7.1.3).

5.6 Expertise and expert performance

H_{01e}: Expertise and expert performance will correlate with all fields; greater degrees of purposeful and deliberate practice will be apparent with subjects who have attained greater second language mastery.

Expertise and expert performance, like SRL, was envisioned as a larger construct under which, or within which, other factors operated; this would be obvious in the realm of experts (hyperpolyglots) and would be conspicuously insignificant towards the opposite end of the expertise spectrum. A portion of the interview stage of this research was designed to gain insight into this area. Statistical analysis of the data is impossible and there were too few interviewees from whom to draw firm inferences, but expertise and expert performance, with both quality and quantity of practice, seems to have a relationship with levels of language attainment in the group of interviewees.

Development of expertise and expert performance requires an approach to growth which pushes skills development with "practice that focuses on tasks beyond your current level of competence and comfort" (Ericsson, Prietula &

Cokely, 2007, p. 2) and one of the hallmarks of expert behavior is that "experts deliberately construct and seek out training situations to attain desired goals that exceed their current level of reliable performance" (Ericsson, 2008, p. 991). This requirement suggests the possibility that, because they are more invested in the process, experts will also be more aware of the process.

As outlined in the results section, the hyperpolyglot DM showed the most depth in his description of language learning. His practice can easily be seen as deliberate based on his scheduling, specific focus, and use of feedback. TY also showed focus devoted to specific goals and, as with DM, seems to have engaged in practice tending towards the deliberate practice end of the spectrum. DM seems to have more of a system for learning than TY, but this is consistent with DM's range of successfully learned languages compared to TY's more modest achievements. It is not unlikely that TY would further refine his techniques if he were to study more languages.

Both DL and AS showed some indications of possible deliberate practice, but their efforts were not as clearly defined nor as consistently applied. The depth of description of their study and practice techniques is not at the same level as DM or TY and, importantly, a deep evaluation of the efficacy of their techniques was not given. While it is not unlikely that some of their practice was deliberate, it seems more likely that both were engaged in proto-deliberate or purposeful practice insofar as their Korean language studies went—in their descriptions of learning Korean they tended towards the purposeful practice part of the spectrum as both emphasized the difficulty of getting engaged with learning it as well as difficulty devoting a high number of hours.

EM and AL both related little information that could be interpreted as tending towards the deliberate practice end of the spectrum. The lack of systematicity in their approaches is seen in their overall lack of specific goals and purposes, beyond a hazy notion of improving language ability, and there is no depth in their analysis of learning styles and techniques. They also lacked a crucial factor: time.

Coaches and teachers are an important part of deliberate practice feedback, but their place among the interviewees did not seem indispensable, or, at least, not obviously so. There are some possible reasons for this. It could be because all the participants have been influenced by their backgrounds in terms of having studied languages. Some of the participants have been influenced through having learned multiple foreign languages, possibly showing what Thompson (2017) describes as perceived positive language interaction (PPLI). That is, their previous experiences in learning second languages has influenced their present learning in terms of aptitude, anxiety, motivation, and learner beliefs. PPLI has, possibly, filled in part of the coaching condition.

It is useful to consider what it is that teachers and coaches offer. Primarily, according to Ericsson et al. (1993), coaches offer feedback and design learning activities to improve levels of skill. It is, of course, easy to understand how teachers and coaches can be helpful in this area: individuals are not always aware of the nuances of their performance, and having another party observe and comment, particularly if the other party has insight or wisdom in the area, allows for more in-depth understanding. The key, in this part, is feedback. The question remains, however, is a ‘coach’ necessary for feedback? DM and TY give nuance to this assertion, displaying, perhaps, PPLI.

TY was very clear that he did not feel the need for a teacher and that he can get feedback from different, less formal, sources. DM is like TY in that his feedback does not need to come from a formal teacher or coach. As mentioned previously, DM has made use of tutors but primarily gets his feedback in the same way as TY, which is through interacting with others and acting on feedback gained in different situations. For example, DM specifically seeks out people who are likely to give him feedback, although not of the type that a tutor or coach typically would:

> *if they* [an interlocutor] *don't understand you then you did it wrong and I think it helps to … talk with old people … old people will never … switch to English to try to help out*

With this brief explanation DM shows a lot about his approach to learning a language. First, the feedback as to the correctness of his speech is gained from the reaction of his interlocutor. Second, because the interlocutor, an old person in this example, does not switch to English as a recourse, the interaction becomes a focused activity in which DM must evaluate his attempt, adjust it, and try again. This is not unlike the process of developing any skill and clearly shows that having a traditional teacher or coach is not a necessary condition for achievement in learning a second language.

While interesting insight and ideas were uncovered, expertise and expert performance with a consideration of hours spent in different types of practice cannot be definitively analyzed in in this research due to the limited number of interviews. This is compounded by the issue with deciding what constitutes an expert in second-language acquisition, dealt with earlier in this thesis. TY, for example, can be seen as an expert due to his success in Korean; AS can be seen as an expert due to her success with German; and DL can be seen as an expert due to his success in French and Spanish. However, TY seems to have

greater overall facility with learning due to his success across language groups, while AS and DL were both unable to achieve comparably in the linguistically distant (from their native languages) Korean. The hyperpolyglot, DM, does seem to fit the description of expert in his descriptions of learning, but like TY, AS, and DL, he does not achieve a high level of ability in all the languages he learns. What does seem to set TY and DM apart from AS and DL is that they seem capable of learning any language, or at least confident of their abilities to learn any language, while AS and DL do not seem confident of a generalized language learning ability but indicate more of an ability with learning specific languages. Considered in this way it might not be incorrect to make categories of expert 'specific' language learners and expert 'general' language learners.

Finally, quality and quantity of hours do not seem to be easily separable when considering degrees of success. A consideration of the relative mix of these two variables can make clear much of the spectrum of success in acquiring a second language. The concept of expertise and expert performance is a powerful tool of explanation, but it suffers from the same issue as grit–expertise and expert performance focuses on high performers. While this is valuable, a wider view could offer more explanatory power.

5.7 Additional systems

As mentioned in the findings section, many sub-systems were noted in the data. Of the areas of interest three were found to be particularly salient due to their ubiquity in the interviewees' responses or because they were easily envisioned as hubs with a potentially strong influence throughout the entire system of language acquisition. These systems are motivation, identity, and a combination of the two, directed motivational currents (DMC).

5.7.1 Motivation

Although it was not a targeted area in the inquiry, the interview portion of this study elicited many responses relating to motivation. The types of motivations were diverse, even in a single interviewee. This is expected as:

> …the number of motivational influences that are fundamental (in the sense that their absence can cancel or significantly weaken any other factors whereas their active presence can boost action behaviour) is far more extensive than each individual theory [of motivation] would suggest. (Dörnyei & Otto, 1998, p. 44)

As part of the complex system of language learning, motivation seems to be a contender for one of the most influential hubs.

The importance of motivation in interviewees' answers is not a surprise as there is a lot of language learning literature where the importance of motivation has been noted (e.g., Dörnyei, 2005; Masgoret & Gardner, 2003; Oxford & Shearin, 1994). In a Bayesian manner, in which a single factor can overshadow all others, it is a factor which can make all other factors inconsequential—if there is no motivation to learn, whether extrinsic or intrinsic, no meaningful learning can take place. It does not matter if a person has a strong growth mindset and a gritty personality, without motivation, without some impetus, all other factors can, and almost certainly will, become meaningless. While there is no question that motivation is essential, it is useful to consider underlying factors and commonalities which affect motivation among the interviewees in this study. Motivation ranged from interest in being unique (related to image and identity, discussed in the next section), to Machiavellian motivation, to interest in the language itself. Instead of expanding all the details of the various types of motivation, it is better to consider the overall influence of motivation in a few areas.

Intrinsic motivation, typically thought of as the better half of the extrinsic/intrinsic dichotomy (Ryan & Deci, 2000), is not the only type of motivation mentioned by the interviewees, but it does seem to be the one that is most commonly mentioned for those languages which have been successfully learned. AS, for example, stresses that her success with German was a result of being interested in the content of her study materials; DL, for French and Spanish, talks about interacting with native speakers of those languages and, in particular, that in his Spanish studies he found that former revolutionaries "were a lot of fun to hang out with and to talk with." Like DL, DM uses the word 'fun,' indicating that he has, or can create, intrinsic motivation for reading, talking, and even reading grammar books.

Extrinsic motivation seems to have limits in many cases. DL states that his lack of success with Korean led him to take structured classes. While this improved his language ability, he was never able to match his level of Korean to his level of other languages. EM is another example where extrinsic motivation has not been able to create great success; while he states that he is intrinsically motivated to learn Korean, that motivation did not translate into sustained effort. To counter this, EM enrolled in language classes, giving himself an extrinsic motivator. Nevertheless, his gains were modest.

While there are probably no types of motivation which are either wholly intrinsic or extrinsic, in this research it seems that motivation which tends towards the intrinsic end of the spectrum is often associated with higher levels of success. This, however, cannot be said to be absolute, mainly because of the experience of TY, whose Machiavellian motivation clearly aided his learning of Korean. Machiavellian motivation has been identified as one way in which there is variation away from a linear relationship between intrinsic motivation and

success (Oller, 1981). TY, while clearly being motivated to learn, for example, *kanji* based on intrinsic motivation (the characters are interesting), his Korean abilities were markedly aided by his reaction to being discouraged from learning Korean. Indeed, upon reaching his goal of getting the top level in the TOPIK, itself an external motivator, his active learning dropped off—he had won the 'I'll show you!' game.

Motivation has a clear relationship with SRL. Pintrich (2004) states that the SRL framework of student learning includes "motivational and affective factors, as well as social contextual factors" (p. 386), and includes, among other things, goal orientation, feelings of efficacy, and consideration of the effectiveness of learning tasks. It is both a primary factor in terms of the initial undertaking of language study, and a mediating factor once language learning is underway. It is impossible to unpick all aspects of motivation, and even if motivation is of the same type, intrinsic for example, there is still an extremely broad subset of factors. Would, for example, TY's Machiavellian motivation for Korean have been sufficient if TY had not been living in Korea? This is unlikely as TY related that he did not continue with Japanese because he is not in Japan; and while he professed an interest in Chinese, he said that he would not be likely to study it unless he were in China. In this study motivation is clearly an important system and is a good example of how factors affect language learning in a Bayesian manner.

The motivation discussed in this section are of the traditional sort, dealing with intrinsic and extrinsic types. Henry, Dörnyei, and Davydenko (2015) go beyond this, considering DMC, which they see as part of a complex system of language learning. This is covered in 5.7.1.2.

5.7.2 Image and identity

One of the more interesting systems, image and identity, was seen in the interviews many times. While image and identity do not ensure success, they do seem to have an influence on learning among the interviewees. This is supported by the literature. Duckworth and Gross (2014) state that "Related research has identified harmonious passion (i.e., autonomous internalization of a passionate activity into one's identity) as a predictor of deliberate practice and, in turn, performance" (p. 2). This gives a direct relationship between identity and motivation as well as the deliberate practice of the expertise and expert performance framework. If a person sees themselves as a language learner, it affects motivation and effort, and this is seen in the answers of some of the interviewees.

For DL, being known as a good language learner created a positive feeling. His self-image motivated him to not only put more time and effort into his language learning during his public-school life, but also motivated him to study Spanish and French in university. Clearly, this identity worked as motivation.

TY also has an identity as a language learner and this likely contributed to his success in learning Korean. He did not, however, apply this identity in the same way as a person who continually studies languages, but more as a person who can effectively learn languages:

> *I've always been driven by the desire to learn far more than the compulsion it's a complicated thing but … of course you do settle into this identity as a language learner so after that I guess it just becomes natural*

His identity, a language learner, helps his motivation because he can approach language learning with confidence of success.

DM's identity is multi-layered, showing the different language identities he is creating as he learns languages as well as a more basal self-image, which is

not surprising considering how language learning is such a pervasive part of his life. The languages he learns allows him to identify with the culture associated with those languages. One of the reasons that he does not, for example, feel as drawn to Spanish as other languages is because he does not see aspects of Spanish-speaking countries that he strongly wants to identify with:

> *Spain is not … the … best European country and then after … Spain comes … Central and South America and a lot of them are basket cases so there's nothing … that you really want to latch yourself to … and … dedicate yourself to … if there's a country with … something cultural that attracts you then you can learn to like the language and that's what happened with German.*

This intrinsic motivation, being identified as influencing learning a second language, is interesting because it helps to make clear one of the possible areas of divergence for people who have had success in learning one language but not another. There is, however, a more basal type of self-image apparent with DM.

DM approaches self-development and self-improvement using his self-image, or at least his ideal self, as a goal. He related that he is learning to play the piano to become a more rounded person and he describes his practice with the piano in much the same way as he does his language learning—find a problem area, focus on it, perfect it, and find another challenge—using deliberate practice. The underlying motivation for learning the piano, which mirrors his language-learning motivation, is to become a better person:

> *I always have a view of … there's me and then there's like a second me that's kind of … better in every way and then I kind of see him judging me a lot … but also hoping … for me … cheering me on … trying to get better trying to be … more perfect … and language learning is kind of part of that because it obviously … teaches you things and you can understand more and more … and not just people but also whatever … content you can find … you can relearn anything. You can relearn your whole self in another language you can take … every single field of study that you've done and you can do it over again in another language and get better.*

This is an excellent example of complexity because it is multilayered and recursive. DM has a mindset in which he can see effort translate into effect, a growth mindset, which, in turn, allows him to see himself as moldable and to work to become a better person; the process which comes out of this would not, however, work in any situation for some people, but because DM is highly self-regulated he is able to approach learning and skills development using effective approaches and strategies, and knowing how much time and effort he needs to dedicate to his tasks. All of this entails DM rebuilding himself, drawing on already gained knowledge and skills, and thereby making himself a better and more complex person; and it is this better and more complex person that continues to work as ongoing motivation.

Image and identity can be considered through a motivational framework. DMC, as discussed in the next section, considers how, among other things, motivation related to image and identity can positively affect language learning.

5.7.3 Directed Motivational Currents

DMC, as mentioned previously, could intermingle the factors of motivation as well as image and identity. DMC could also clarify the consideration of grit in this research, and could serve to nuance, or even to work as a system which could take the place of flow.

In terms of motivation, DMC can be considered as a system higher on the hierarchy than some of the other systems included in this paper. That is, it combines some of the models of motivation, such as self-determination theory, adding to it the additional aspects of goal-setting theory, flow, and future time perspective (FTP) (Dörnyei, Ibrahim & Muir, 2018). These factors work together to ‘direct’ effort, possibly leading to sustained development of skills. This is an

expanded view of the motivation uncovered in this research and discussed in 5.7.1.1.

DMC has been considered in relation with flow in that flow might be a subsystem of DMC. Dörnyei et al., (2018) see flow as engrossment in short-term tasks and suggest that flow might be present at times over the course of DMC, but DMCs work over a longer timeframe than flow. Henry et al. (2015) suggest that a DMC stands apart from flow in that it has "a higher order vision to which the individual aspires" (p. 2) and that it is both driven and endures through its own power. DMCs, then, incorporate the dimension of image and identity (discussed in 5.7.1.2). When considering the hyperpolyglot DM, DMC might seem like a candidate to describe his system of motivation as he expressed that he has an ideal self which he is working towards and that language learning is part of that process.

A DMC can also be considered through a possible relationship with grit. Dörnyei et al. (2018) state that a DMC "augments and sustains exerted effort" (p. 103). In the present study it was found that the grit factor of persistence of effort had a stronger effect on language achievement than the persistence of interest factor. Ibrahim (2016) suggests that interest is not a necessary condition because FTP can be a motivational force facilitating engagement with dull but obligatory behaviors. This could be descriptive of both TY and AS, as both had bursts of effort directed towards, in TY's case, Korean, and in AS's case, German. Their motivation brought them to the levels they were striving for.

5.8 Synergy between systems

H_{02}: Those with greater facility and range for learning languages will show more complexity in the fields being researched.

The hypothesis seems viable based on the interview data, but because of the small number of participants it would be an overstatement to declare that the hypothesis is accepted. Nevertheless, based on the data collected the hypothesis seems to hold true in the context of the present research.

The effects of each of the factors do not seem to have a multiplying effect which each other but, rather, influences that interact—just not in a dramatic synergistic boom. Synergy between the systems is difficult to make concrete. The countless variables affecting the language learning trajectories of the participants in this research means that the attempt to show the influence between the factors overlooks the influence of the multitude of factors not examined. Nevertheless, relationships between factors, and the general strength of the individual factors, can be considered.

First, SRL seems to be the closest to a hub of the systems considered in this research. First, it had the strongest relationships with the other factors in the statistical analysis and in relation to the interview data. It also seems closely related to expertise with the higher-performing language learners—that is, to be an expert in learning languages, particularly in the absence of a teacher or a coach, the learner should be self-regulated. The self-regulation, however, seems to rely on the situation. DL, for example, scored reasonably highly on the SSRQ (his score was 3.9) and while his answers relating to French and Spanish seemed to indicate that he was strongly self-regulated in those languages, his answers for Korean showed some attempts at self-regulation but far less success and flexibility. SRL tends to be linked to specific fields of

endeavor (although it can be taught as a transferable skill), but is it possible that SRL in language learning can be relative to the language being learned instead of a general language-learning ability? For example, it is easy to envision a native English speaker approach learning Spanish differently than Korean. An English native speaker reading the Spanish word *infraestructura*, for instance, could easily guess the meaning because it looks like the English 'infrastructure.' Even ĩm̩.fɾa.ɛs.truk̃.ˈtu.ɾa has a similar enough sound to ˌɪnfrəˈstrʌktʃər that a guess of the meaning is possible. However, the Korean 인프라 (inp'ŭra) has neither visual nor aural similarity to English even though it is a loanword from that language, meaning that the strategy of intelligently guessing has reduced viability. In this way, a higher score in SRL might be reflected in learning some languages but not others.

For EM and AL self-regulation seemed to be lacking. In EM's case, he learns Korean through formal means as he seems to benefit from other-regulation. AL has neither self-regulation nor other-regulation, meaning that despite Korean being the language she first learned as a child, presumably an advantage, she has not been able to appreciably improve her facility with the language.

For AS and DL self-regulation seems to have been a part of their learning of languages other than Korean, while other-regulation became important for that language. This is possibly because both AS and DL did not find Korean particularly interesting and required outside motivators. It is also possible that language distance is at play, which is shown with DL's description of the accessibility of French and Spanish, where the grammar is not vastly different

from his native language of English and where word meaning can often be guessed because of similarities to English.

For TY and DM, self-regulation seems to form the basis of their language achievements. They are self-driven, and they show facility with shaping their learning environments and activities. Even in their interactions with other people they are not necessarily using them as coaches but, rather, using them as resources.

The relationship to mindset and SRL is clear. There is a minimum level of a growth mindset required to independently undertake the effort of learning a language. The mindset score is likely not static as a person's success, or lack of success, in their language learning endeavors would recursively affect a person's mindset. There is also a very important point—a fixed mindset does not preclude success. If a person has a fixed mindset but meets with early success that person might conclude that they have a talent for an endeavor and continue to put in effort. In this study, DL had a low mindset score, and yet still learned three additional languages to an intermediate/advanced level.

TY and EM, with 2.5 and 2.0 mindset scores respectively, scored in the same range but differed in language learning success widely, with EM having never passed above the low beginner stage in French and having achieved only the low-intermediate stage in Korean. TY, on the other hand, learned Spanish to low-intermediate and Korean to high-intermediate levels despite his tendency towards a fixed mindset. This can possibly be explained through the complex system concept of sensitive dependence on initial conditions: EM had never had much success in learning a second language when he was younger as shown by his level of French, but TY did show some success when younger, as seen with his Spanish. Importantly, TY related the story of his grandfather

teaching him to count in Spanish when he was very young. It is not hard to imagine that something as simple as counting put TY ahead of his peers in school when Spanish was first taught, and this led to a cycle of competition and effort to preserve his self-image, a fixed mindset self-image, of himself as a good language learner, leading to grit in language learning as a means of ego preservation or maybe a virtuous cycle.

5.9 Issues and limitations

There are several issues with this research which come from concerns inherent in the data-gathering methods as well as issues of a more global sort. While the issues do not negate the legitimacy of the general ideas discussed, they do indicate areas which reduce the power of any possible conclusions.

A primary issue is that a consideration of a complex system should have the dimension of time to determine how systems and sub-systems evolve, and while this research focuses on the use of complex systems as a metaphor, it became clear over the research that a longitudinal approach to the research would have been more illuminating. Such an approach would be especially enlightening if the research into complex systems in second language learning could be approached as an experiment in which participants have factors measured at the beginning of their second-language learning endeavors and periodically assessed over a longer span of time, allowing for a comparison with second language learning skill development. Case studies of language learners, inclusive of hyperpolyglots, or an ethnography of a group of hyperpolyglots would be worthwhile.

There are issues with the scales used which go beyond using general scales to elicit data about factors related specifically to learning languages, including respondent error and respondent tendencies. Are Likert scales likely to be

accurate when comparing a cultural cross-section of learners? Asian cultures, for example, tend to avoid the extremes and mark closer to the midpoints, opting instead for a 'hedged' response which would result in lower highs and higher lows (Wang, Hempton, Dugan, & Komives, 2008). Does the data coming from Asian respondents bring down the mean of the group, or, from a different point of view, does the scoring from non-Asian respondents bring the mean score up? Direct comparisons of scores are difficult.

The next issue stems from the previous and relates to individual tendencies of self-scoring on Likert scales. It became obvious in the interview portion of the research that, in some cases, the interviewees' scores on the instruments being used did not seem to accord with their answers to questions. AL, for example, scored relatively highly on all measures, indicating that she is self-regulated, has a growth mindset, is gritty, and experiences flow; yet, aside from mindset, relatively little of her interview indicated that these measures were accurate. Also, does the 3.3 which both AL and TY got for grit mean the same thing? It seems unlikely as TY pushed himself to learn Korean while AL, even starting from a more advantageous position having spoken it as a child, did not seem to show grit as it relates to learning that language. This discrepancy could come from many sources, indicating issues with either the quantitative instrument or the interview in terms of either (or both) the questions or approach to interviewing. It could be useful to pursue separate research which uses these instruments independently.

Self-reporting language abilities is also a problematic. As mentioned previously, language distance is an issue because two languages might be very similar to one another to the point where it is debatable whether a person speaks a different language. This was apparent when some respondents on the

online form listed various related creoles and pidgins, some of which were similar to one another. A bigger issue with self-reporting language abilities, however, is with the self-reported levels. How accurate were the respondents at determining their language levels? AL, TY, and DL all put their levels of Korean at B2, and EM and AS put their levels at B1. However, in interacting with the participants, based on the limited Korean used, DL seemed more likely to be a high B1 and TY closer to C1; EM, if he is B1, is on the low end of B1, while AS is more solidly a B2. As discussed in 3.2.1, some studies show that self-assessment is relatively accurate, while other studies show that self-assessment has some issues with accuracy. Edele, Seuring, Kristen, & Stanat (2015) found that some types of self-assessment are inaccurate with particular groups and recommend caution in using such measures in research relating to levels of language ability.

The obvious solution to this would be to use third-party language assessments, such as the International English Language Testing System (IELTS), the Diplôme d'Etudes en Langue Française (DELF), or the Hanyu Shuiping Kaoshi (HSK). While information on formal language testing results was collected in the course of this research with a view to triangulation, the official results reported by the participants was sporadic and there was not enough to be usable. As mentioned earlier in this research, funding language tests would probably be impractical due to the financial burden on the part of the researcher as well the time burden on the part of the participants. Yet, if some means of minimizing these deterrents, such as getting sponsorship from companies and voluntary participation from language learners, could be arranged, the resulting data could be enlightening not only to determine the

validity of self-reporting, but also to consider concepts such as the Dunning-Kruger (Kruger & Dunning, 1999) effect in language learning.

There is also an issue with the statistics themselves. Choosing a method of statistical analysis is challenging and there is an amount of second-guessing after a method has been chosen. Multiple regression, for example, seems on the surface to be a good candidate for analyzing the data, but for different reasons, such as multicollinearity between some variables (e.g., there are motivational elements on the grit scale and the SSRQ) it was discarded; additionally, the data had outliers (the hyperpolyglots), so other choices also had to be rejected.

As mentioned previously, the statistical measure used, Spearman's rho, was chosen for many reasons, one being the assumption that, while not perfect, a loose monotonic relationship between variables could indicate that a field might have a positive effect on language learning. This, of course, implies a linear relationship between variables, but in a complex system nonlinearity is the standard.

Selection bias is another possible issue, and the low correlations between the different fields and language attainment might have resulted from this, as the sample population was biased. Although an attempt was made to include people not interested in learning languages through posting links in non-language related places such as Reddit, most of the respondents seemed to come from the language-related postings (for example, the Polyglot Conference Facebook page). This could have skewed the results, affecting the range of scores.

The next issue is the minimum value of the factors measured. If the factors come into play through a means akin to an activation function, how much is enough to engender successful language learning? Is there a tipping point or a tipping range which is good enough? It would be naïve to think that there would be a perfect monotonic relationship between, for example, mindset and language achievement, where one decimal place higher on the mindset scale will equal one additional language or a higher language level. A very strong growth mindset and a slight growth mindset may not show any discernable difference if both are past a point that is adequate to engage in and continue future learning. Is, for example, a score of 2.6 on the mindset instrument enough to maintain a series of actions after which no higher score will have any additional effect? It is not unlikely that there is a ‘good-enough’ level, beyond which any additional effects diminish, and this ‘good-enough’ level is certainly not a static number.

The final issue is with the qualitative portion of this research. It was initially felt that interviewing a small sample of language learners representing various degrees of ability would add depth to the findings, and this was the case. During the data analysis it was found that the interviews contained fascinating insight but, unfortunately, there were not enough interviewees in the study for strong conclusions to be reached. The interviews did seem to confirm some of the hypotheses, but without many more interviews this cannot be definite. Further, as mentioned previously, Additional research conducted in the same manner as this study, but with many more interviewees, would be a valuable endeavor.

6 Conclusions

Language learning is a complex endeavor involving countless factors interacting in different ways at different times, and not a checklist of factors that, if satisfied, would guarantee success with a second language. Mitchell (2009) suggested “It might be better to scale back and talk of common rather than general principles” (p. 294), and in this research an attempt was made to do that. The purpose of this research was to examine some ‘big things’ and their interactions in the complex system of second language learning (self-regulated learning, mindset, grit, flow, and expertise and expert performance) as well as to consider how these factors interact with language learners who range from those with limited facility in a second language (those tending towards monoglottery) to the extreme of hyperpolyglottery.

The findings, in line with Mitchell’s (2009) suggestion, tend towards common rather than general principles. The factors examined show a relationship with levels of attainment in learning additional languages, but a strong monotonic relationship is not apparent. Of the factors examined, SRL and practice (practice as envisioned by the expertise and expert performance framework ranging along a continuum of naïve to deliberate) are the most significant, with other factors possibly acting as mediators. Practice considered in terms of quantity and quality of time, as gleaned from the interview portion, seems to be a necessary factor for high levels of attainment in learning second languages and varying mixes of quality and quantity can possibly be used to describe language learning outcomes. Both quality and quantity of time seem to be intertwined with SRL—to get both, it is beneficial to take charge of learning and to adapt to conditions and the specific language(s) being learned.

Other factors do not seem have strong influences, although they do seem to have varying effects. The factors of mindset, grit, and flow might influence learning, but not, in this research, strongly so. It is possible that the benefits or requirements of these factors, if any, would be satisfied with a minimum value in much the same way, for example, as the intake of vitamin C—after a level has been satisfied there is no advantage to getting more. Additionally, in an evolving system any of the factors could be necessary at a point of divergence or as a sensitive dependence on initial conditions—their presence (or perhaps necessary lack of) could have ramifications only at specific points in development—this is a problem unanswerable in this research.

A notable finding in the research comes the grit factor of consistency of effort and how it seems to outclass the grit factor of consistency of interest. If considered through the expertise and expert performance framework, specifically quantity of practice, there is a clear relationship as a consistent effort is one which will begin to add up hours of practice. It could also be related to the finding that flow is not as important a condition for high levels of achievement as originally hypothesized. As discussed earlier, flow was included because it was felt that it could help explain motivational aspects of sustained learning and in this way, it could be considered as having a possible relationship to consistency of interest. Ericsson (2007) stated that flow and deliberate practice are not compatible, but Ericsson's view was later tempered, and he suggested that flow is not incompatible with deliberate practice (Ericsson & Pool, 2016). Nevertheless, the rationale for his initial rejection seems to be valid here: interest and enjoyment are trumped by effort.

In complex systems variables need not have positive relationships to positively influence outcomes. Holland, for example, makes the following point:

> The most difficult activity in the conduct of science or business is the early, sometimes costly, activity that makes possible later, obviously good actions. As in the game of chess, it is often an early sacrifice of piece (a gambit) that makes possible a good later move. (Holland, 2006, p. 7)

Holland is talking about credit assignment, where it is very difficult to know the early conditions which lead to eventual success, describing the importance of sensitive dependence on initial conditions. There is, however, more which can be extrapolated.

De Bot and Verspoor (2007) explain that because systems are always changing and reorganizing, they are different in how they react to input, meaning that some input might have an effect at a point in time, but the same input might have no effect at a different point.

How the factors considered in this research interact and how language-learning synergy manifests is difficult to determine and remains in the realm of the speculative. In the context of this research it seems that the factors do not combine to produce an exponentially-increased ability to learn languages, but, rather, effects seem to be logarithmic—there is possibly a Pareto optimum for language learning, and as it is approached the Pareto front shows less malleability. Hyperpolyglots, particularly those who can learn languages which are linguistically distant from the other languages they know, are likely operating near a Pareto optimum of factors; those who can learn to speak linguistically related languages are near a Pareto optimum as it relates to the languages they have learned; those who speak one second language possibly have a different Pareto front profile which could be improved to learn other languages; while those who have shown limited ability in learning languages are not near an

optimum and could change many of the factors of learning without disadvantaging the other factors—almost any change would be an improvement.

6.1 Applications

Despite shortcomings this research has practical application for language learners both for the classroom and for independent learners. In both cases the application is not direct but, rather, a framework within which to operate. This framework is, of course, that of language learning as a complex system where easy answers to complex problems do not exist but where ‘big things’ can be adopted to come closer to a Pareto optimum of language learning. As mentioned in the literature review, there are possibly tweaks to learning which can be made which would influence the entire system.

The most important finding from this research that language learners and teachers (or coaches) should be made aware of is the importance of the interplay between quantity and quality and how to consider this through SRL—learners would benefit from the ability to analyze their own learning to determine how effective their approaches are, how they can be improved, and whether they are putting in enough time to achieve their goals. Teachers (or coaches) could, perhaps, focus on teaching not only SRL, but also designing specific activities to match areas where students need to focus. This leads into an approach of deliberate, or at least purposeful, practice.

Encouraging a consideration of the quantity of hours a language learner puts into learning is a straightforward activity and one which could help both learners and teachers in terms of creating realistic expectations as well as a means of evaluating the efficacy of techniques and approaches. For example, a student

taking a three-credit university-level language class might expect appreciable gains over a semester, but 45-48 hours spread over many months is unlikely to have an appreciable effect as the hours are too few. A realization of this could lead to several outcomes, such as students putting in more time outside of class in order to reach their goals, not getting discouraged due to a seeming lack of progress, or even reevaluating their entire language-learning approach to get enough hours.

The quality of hours is also, while tricky to analyze, something that both teachers and language learners would benefit in considering. Teachers could consider the concept of deliberate practice and design lessons around it. For instance, if teachers notice that students are not able to pronounce a specific sound, rather than ignore it they could consider a way to not only teach it, but to make it a central point in classroom practice, thus creating a training situation in which students are focusing on areas of difficulty. This can be extended to teaching students how to approach problem areas outside of the classroom in a like manner to DM, who, upon finding a problem, focused on it.

Although not drawing specifically on the expertise and expert performance framework, both quantity and quality are concepts underlying many books by hyperpolyglots (Lewis, 2014; Rawlings, 2018; Lomb 2008). Benny Lewis (2014), for example moved from poor performance in learning German, Irish, and Spanish, to becoming fluent in all those languages by changing his approach in terms of both quality and quantity. Kató Lomb (2008) attributed her success in learning languages to interest and time, saying that she learned how to learn languages by making a method to learn English and subsequently applying it to

other languages—her method relates to getting the maximum benefit from the time she invested in learning.

Applying my research in the classroom has proven satisfying and is seemingly effective. Since beginning my EdD studies, I have reinforced and refined my conceptualization of my students as people with the capacity to achieve more than they thought they are capable of, and myself as a person who is in a place to give them direction and tools for achieving personal success not only with English, but any endeavor. Additionally, I have overtly taught the concepts covered in this research (as well as a few additional systems) and I have found the students generally receptive to the ideas and, largely, thankful for exposure to the concepts we cover. A paragraph from a student[7] sums this up:

> Finally, I will give you some tips about having a good attitude ... The kind of attitude that I am talking right now is, 'growth mindset' and 'self-regulated learning'… Listen carefully because personally this is the concept that changed my learning and life living style. The most important point with these attitudes it that you should always be aware that you have the potential to learn and develop. There is no one who is better at learning than others. I mean all the concepts such as IQ is probably close to fake! If you truly want to develop yourself, learn. But the learning is not just about the amount of time. You should actually try to make a high-quality learning by regulating yourself. Do not just strictly follow the course that university demands you. If you ever have any area that you are interested, just put yourself in that area with grit! Do not procrastinate (you will also learn more about these words during the class. Just think of it as–be passionately involved in your activity, do not hesitate). To tell you my example, I am trying this not only on the area of learning English but also taking photography. I study photographic theories myself and I totally involve myself into photography while taking photos. Just like my case, if you ever study English or do other activities in your life with this kind of attitude, I bet you will improve, at least more than the last time.

[7] The title of this bonus assignment is "Letters to Future Students," and its intention is to give students who take may take my courses some insight based on the experiences of past students.

The concepts covered in this paper, taught in the class of the student above, can clearly have an impact.

6.2 Future research

Throughout the research process many points of interest were uncovered and future research considering the interaction of multiple factors on language achievement could go in countless directions. Additionally, over the course of this research the landscape of the field has changed.

Future research should consider the issue of language reporting. First, the CEFR has been updated (Council of Europe, 2018), meaning that a new, and possibly better, language self-assessment instrument is available. Also, several additional areas of can be considered. The area of motivation is well researched in the literature and it only needs to be integrated as part of the whole system, possibly using the DMC framework. Additionally, a view of the system of second-language learning would benefit from a consideration of other factors such as goals and goal setting, satisficing, and, perhaps, mindfulness.

Goals and goal setting, a well-established field, would add more nuance to the study. The qualitative data indicated that there was a difference in the goals of the interviewees, with the more successful learners having clearer goals. A contrast of goals as well as an analysis of specific goals could illuminate areas which would benefit learners and would dovetail nicely into the determination of what makes practice deliberate.

Satisficing is also an interesting area for future inclusion. How much is enough? Optimization, or a maximally high outcome, is not the goal of all people in all situations. A person who is satisficing “is looking for something that crosses the threshold of acceptability—something that is good enough,”

(Schwartz et al., p. 1179). Aside from the hyperpolyglots, learners are not involved in a never-ending quest to learn more languages or to improve the ones that they know. At what point(s) do learners consciously, or unconsciously, decide that their achievements are enough? If there is unconscious satisficing evident, could that help explain a lack of further progress in learning a second language despite continued effort? Satisficing could be intertwined with many different factors, perhaps as a mediating condition adding explanation to a lack of further gains in language ability. Satisficing could also be used to consider the types of practice that learners engage in: while deliberate practice is the gold standard, is it necessary for people who only want or need to reach a level of basic communicative competence? It is possible that the type of practice used by learners reflects satisficing, and that for some learners purposeful practice is sufficient to reach their goals as they neither want nor need to be experts in their second languages.

Finally, mindfulness might be able to add nuance. Flow was chosen for inclusion in this research primarily because it was felt that the intense focus of a flow state was strongly related to deliberate practice. It seems, however, while not incompatible with deliberate practice, flow is not a required condition for deliberate practice. Mindfulness, on the other hand, might account for the levels of attentiveness necessary for deliberate practice. Comparing the results of the Mindful Attention Awareness Scale, for example, to success in learning second languages could provide insight in the complex system of language learning and the expertise and expert performance subsystem as it relates to types of practice.

6.3 Concluding statement

Language learning is complex; this does not seem a satisfactory conclusion, reflecting as it does a similar statement made in the introduction.

Language learners are diverse; this, likewise, seems to lack the thunderbolt of sagacity hoped for in a conclusion.

Concluding is difficult under a complexity framework. To say that both language learning and learners are complex is neither profound nor conclusive, but it is accurate. Pat Sikes in Bassey (1999) states that "'fuzzy generalizations' are more honest and more appropriate to much research in educational settings than are definitive claims for generalizability because of the complexity that is usually involved" (p. xi). This view seems accurate.

Specific systems have been considered in this research and additional systems for consideration have been mentioned, but these systems should not be interpreted as unshakeable requirements for language learning. They all play a role in the systems of language learning held by individual language learners and contribute to individual fitness landscapes. A wider view of a greater number of language learners will give a better survey of these landscape and this study is a small part of that process.

7 Appendices

7.1 Appendix A: Survey

Duane's Survey

My name is Duane Henning and I am a doctoral student at the University of Exeter. My research is intended to gather information about various concepts in order to consider how these concepts interact with and affect language learning. In particular, I am looking at self-regulated learning, mindset, grit, flow, and expertise & expert performance in the context of a complex adaptive system of second language learning.

The information gathered in this research:
- is confidential and will be shared only in anonymized form;
- will be stored indefinitely;
- will be password protected;
- will be used to write my dissertation, research papers, and as content for presentations.

If you have any concerns you can contact me at ddh202@exeter.ac.uk

* Required

1. **Please click the box below to indicate that you understand the purpose of this research.** *
   Check all that apply.
   ☐
2. **Please enter your name** *
   _____
3. **In what year were you born? (Not required)**
   _____
4. **Please enter your native language(s).** *
   _____
5. **Please enter your nationality or your cultural background -- whichever you associate more strongly with.** *
   _____
6. **Would you be willing to participate in a follow-up interview about language learning?** *
   Check all that apply.
   ☐ Yes
   ☐ No
7. **Please enter your email address. It will not be given to any third parties. It is only for me to contact you if necessary. (not required but helpful)**
   _____
8. **If you have any questions, comments, or concerns about this section please let me know. (Not required)**
   _____
   _____
   _____
   _____
   _____

Language Abilities

This section is to get an overview of your language skills. Below is a list of spoken interaction descriptors from the Common European Framework of Reference (CEFR)© for languages. A1 is the lowest ability level and C2 is the highest.

- For each language you speak list it under the descriptor which best describes your level of ability.
- Leave the fields blank if you speak no languages at the described level.
- The descriptors are as written in Common Reference Levels: Global scale. Please consider the items as self-evaluation (ie., "he/she" should be considered as "I").
- Please put the estimated age in which you started learning any of the languages you list.

For example, if you began studying French when you were 6, Russian when you were 23, Korean when you were 24, and Spanish when you were 34, you would fill out the sections below in this way:

A1
Russian 23, Spanish 34
A2
French 6
B1
Korean 24

The CEFR is made by Council of Europe / Conseil de l'Europe©

9. **A1 - Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.**

10. **A2 - Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate basic need.**

11. **B1 - Can understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc. Can deal with most situations likely to arise whilst travelling in an area where the language is spoken. Can produce simple connected text on topics which are familiar or of personal interest. Can describe experiences and events, dreams, hopes and ambitions and briefly give reasons and explanations for opinions and plans.**

12. **B2 - Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation. Can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party. Can produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and independent disadvantages of various options.**

13. **C1 - Can understand a wide range of demanding, longer texts, and recognize implicit meaning. Can express him/herself fluently and spontaneously without much obvious searching for expressions. Can use language flexibly and effectively for social, academic and professional purposes. Can produce clear, well-structured,detailed text on complex subjects, showing controlled use of organisational patterns, connectors and cohesive devices.**

14. **C2 - Can understand with ease virtually everything heard or read. Can summarise information from different spoken and written sources, reconstructing arguments and accounts in a coherent presentation. Can express him/herself spontaneously, very fluently and precisely, differentiating finer shades of proficient meaning even in more complex situations.**

15. **If you have any formal language testing results (ie., DELF, HSK, TOPIK, IELTS, etc.) please list the test and the results here.**

16. **If you have any questions, comments, or concerns about this section please let me know. (Not required)**

Short Self-Regulation Questionnaire

Please respond to the following question selecting the response that best describes how you are. There are no right or wrong answers. Work quickly and don't think too long about your answers.

17. **I usually keep track of my progress toward my goals.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

18. **I have trouble making up my mind about things.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

19. **I get easily distracted from my plans.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

20. **I don't notice the effects of my actions until it's too late.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

21. **I am able to accomplish goals I set for myself.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

22. **I put off making decisions.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

23. **It's hard for me to notice when I've 'had enough' (alcohol, food, sweets).** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

24. **If I wanted to change, I am confident that I could do it.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

25. **When it comes to deciding about a change, I feel overwhelmed by the choices.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

26. **I have trouble following through with things once I've made up my mind to do something.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

27. **I don't seem to learn from my mistakes.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

28. **I can stick to a plan that's working well.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

29. **I usually only have to make a mistake one time in order to learn from it.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

30. **I have personal standards, and try to live up to them.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

31. **As soon as I see a problem or challenge, I start looking for possible solutions.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

32. **I have a hard time setting goals for myself.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

33. **I have a lot of willpower.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

34. **When I'm trying to change something, I pay a lot of attention to how I'm doing.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

35. **I have trouble making plans to help me reach my goals.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

36. **I am able to resist temptation.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

37. **I set goals for myself and keep track of my progress.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

38. **Most of the time I don't pay attention to what I'm doing.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

39. **I tend to keep doing the same thing, even when it doesn't work.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

40. **I can usually find several different possibilities when I want to change something.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

41. **Once I have a goal, I can usually plan how to reach it.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

42. **If I make a resolution to change something, I pay a lot of attention to how I'm doing.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

43. **Often I don't notice what I'm doing until someone calls it to my attention.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

44. **I usually think before I act.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

45. **I learn from my mistakes.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

46. **I know how I want to be.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

47. **I give up quickly.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

48. **If you have any questions, comments, or concerns about this section please let me know. (Not required)**

Flow State Scale (FSS-2)

For the following section please consider your language learning experiences.

49. **I feel just the right amount of challenge.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

50. **My thoughts/activities run fluidly and smoothly.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

51. **I don't notice time passing.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

52. **I have no difficulty concentrating.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

53. **My mind is completely clear.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

54. **I am totally absorbed in what I am doing.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

55. **The right thoughts/movements occur of their own accord.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

56. **I know what I have to do each step of the way.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

57. **I feel that I have everything under control.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

58. **I am completely lost in thought.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	◯	◯	◯	◯	◯	◯	◯	Very much

59. **If you have any questions, comments, or concerns about this section please let me know. (Not required)**

Mindset

This questionnaire has been designed to investigate ideas about intelligence. There are no right or wrong answers. I am interested in your ideas. Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by clicking the number that corresponds to your opinion in the space next to each statement.

60. **You have a certain amount of intelligence, and you can't really do much to change it.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

61. **Your intelligence is something about you that you can't change very much.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

62. **No matter who you are, you can significantly change your intelligence level.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

63. **To be honest, you can't really change how intelligent you are.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

64. **You can always substantially change how intelligent you are.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

65. **You can learn new things, but you can't really change your basic intelligence.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

66. **No matter how much intelligence you have, you can always change it quite a bit.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

67. **You can change even your basic intelligence level considerably.** *
Mark only one oval.

	1	2	3	4	5	6	
Strongly Agree	◯	◯	◯	◯	◯	◯	Strongly Disagree

68. **If you have any questions, comments, or concerns about this section please let me know. (Not required)**

Short Grit Scale

Here are a number of statements that may or may not apply to you. For the most accurate score, when responding, think of how you compare to most people -- not just the people you know well, but most people in the world. There are no right or wrong answers, so just answer honestly!

69. **New ideas and projects sometimes distract me from previous ones.** *
Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

70. **Setbacks don't discourage me. I don't give up easily.** *
Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

71. **I have been obsessed with a certain idea or project for a short time but later lost interest.** *
Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

72. **I am a hard worker.** *
Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

73. **I often set a goal but later choose to pursue a different one.** *
Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

74. **I have difficulty maintaining my focus on projects that take more than a few months to complete.** *

Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

75. **I finish whatever I begin.** *

Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

76. **I am diligent. I never give up.** *

Mark only one oval.

	1	2	3	4	5	
Very much like me	◯	◯	◯	◯	◯	Not like me at all

77. **If you have any questions, comments, or concerns about this section please let me know. (Not required)**

Thank you

Thank you for participating in my research. If you would like details of what I am studying please send an email to ddh202@exeter.ac.uk or leave a comment below.

78. **Do you have any questions, comments, or concerns about this survey? (Not required)**

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7.2 Appendix B: Semi-structured interview

SSRQ

Prompt:

Your answers in this area reflect your level of self-regulation. Self-regulation deals with how much a person takes charge of his or her own learning and how active, rather than passive, a learner is.

Your score is _____, which indicates that you are not/moderately/highly self-regulated.

Do you think this result is accurate? How much responsibility do you take for your learning and why do you think so?

Flow

Prompt:

The next area we considered is flow. Flow is an area of positive psychology dealing with the quality of our lives in terms of satisfaction and happiness. Mihály Csíkszentmihályi is the originator and most well-known researcher in this field. What he has found is that those who are the most satisfied with their lives are the people who most often are in flow states.

Your flow scale looks like <show flow scale>, which indicates that you are often/sometimes/rarely in flow.

Can you describe to me how you feel when you are studying/learning/practicing languages? Can you tell me about any flow experiences that you've had which are related to language learning?

Mindset

Prompt:

Mindset is an area which deals to how we view intelligence. There are two orientations: a fixed mindset and a growth mindset. A person with a fixed mindset feels that intelligence is something that you are born with and either have or do not have. A person with a growth mindset feels that intelligence is something that you can develop.

Typically, people with fixed mindsets avoid challenge and those with growth mindsets welcome it.

Here is your mindset score: <mindset score>. This indicates that you have a fixed/growth mindset. In terms of language learning, how do you think that your mindset affects your levels of achievement?

Grit-S

Prompt:

Grit deals with a person's passion and perseverance for long-term goals and is a good predictor of success in a number of different areas.

Essentially, a person with grit will focus on their goals and work to overcome blocks which get in the way. A person with lower grit is more likely to quit when things get tough.

Your grit score is <grit score>, which indicates that you are high/moderate/low in grit. Can you give examples of how grit has affected your language learning?

Expertise and Expert Performance

Prompt:

Expertise and expert performance deals with how people become experts. Typically, experts engage in many hours of deliberate practice, while those who do not reach such high levels either practice much less or engage in ineffective practice. The following questions are to determine what type of practice you engage in.

1. Are the tasks and materials you use for learning and practice the right level of difficulty? Explain.
2. Describe the feedback that you get in your language studies.
3. Do you get repetition in your language learning and practice? Explain.
4. How much do you (or did you) practice languages every day, every week, every month, or every year?
5. Was your practice effective? Why or why not?

7.3 Appendix C: Interviewee Consent Form

Thank you for agreeing to participate in the interview portion of this research. My research is intended to gather information about various concepts in order to consider how these concepts interact with and affect language learning. In particular, I am looking at self-regulated learning, mindset, grit, flow, and expertise & expert performance in the context of a complex adaptive system of second language learning.

The information gathered in this research:

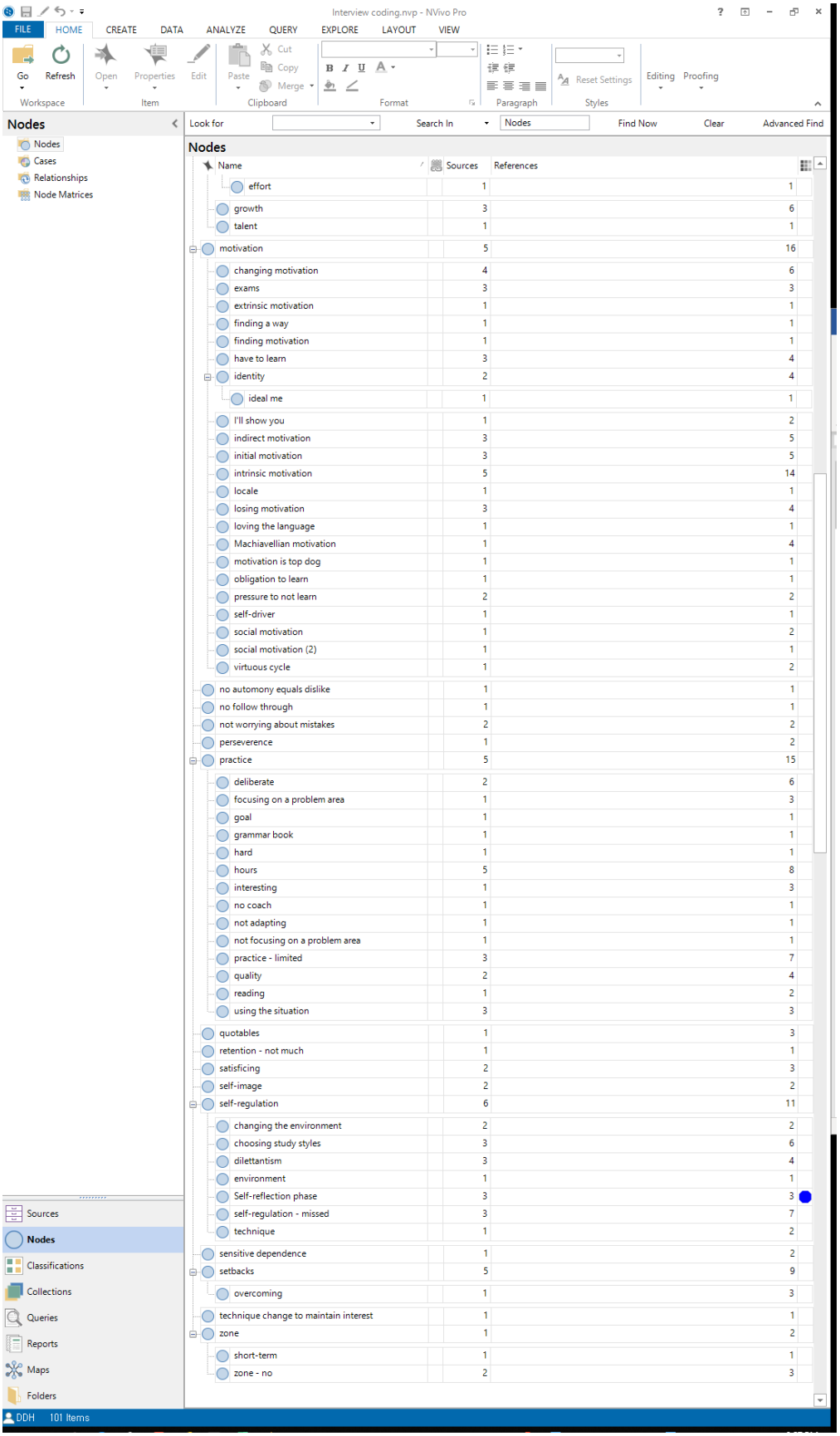
- is confidential and will be shared only in anonymized form;
- will be stored indefinitely;
- will be password protected;
- will be used to write my dissertation, research papers, and as content for presentations.

There is no obligation for you to participate in this research and should you desire to withdraw at any point you should not hesitate to do so.

Please indicate that you understand the above by verbally stating so or by checking the box. ☐

Name: _____ Date: _____

7.4 Appendix D: NVivo Screenshot



7.5 Appendix E: Ethical Approval

GRADUATE SCHOOL OF EDUCATION

St Luke's Campus
Heavitree Road
Exeter UK EX1 2LU

http://socialsciences.exeter.ac.uk/education/

CERTIFICATE OF ETHICAL APPROVAL

Title of Project: 'Synergy Storm – Hyperpolyglots as an Attractor State of a Complex Systems of Self-Regulation, Expert Performance, Mindset, Grit, and Flow'

Researcher(s) name: Duane Henning

Supervisor(s): Philip Durrant; Andrew Richards

This project has been approved for the period

From: 8th November 2016
To: 31st March 2017

Ethics Committee approval reference: D/16/17/08

Signature: Date: 9th November 2016
(Dr Philip Durrant, Chair, Graduate School of Education Ethics Committee)

7.6 Appendix F: Interviewee Bios

EM was born in the middle east to British parents. He was raised in England and graduated from one of the top universities in the UK with a degree in philosophy. He worked for a few years as a teacher, first in Sri Lanka and later in the UK, before moving to Seoul where he worked for two years as a teacher and then moved into curriculum research and development. At the time of the interview he had been working in Korea for five years and had studied Korean both independently as well as in a classroom environment.

AL was born in Korea and lived there until kindergarten, after which her family emigrated to the U.S. After arriving in the U.S. her primary mode of education and interaction was through English. In high school she became interested in Japanese and studied it independently. After finishing high school, she attended university and received a degree in East Asian studies, before moving back to Korea. Her primary reason for moving to Korea was personal, and she worked as a private institute teacher while pursuing on online MA TESOL. After receiving her MA, she began to work teaching English in the Korean university system.

DL was born and raised in the Rust Belt of the U.S. He was educated in public school and this is where he began to feel an attraction to languages, particularly Spanish and French. After finishing his secondary education, DL attended university and graduated with a degree in French and a minor in Spanish, afterwards spending time working in a call center where he could use his language skills.

Due to the poor economy of his hometown, DL moved to the Pacific Northwest and worked as a legal assistant. After living in the Pacific Northwest for three years, DL decided that he wanted to travel and to study an Asian language. He moved to Korea to do both, leveraging the Korean English fever and his education to get a job in a private language school, and later in a Korean university. During this period, he used a self-study approach for learning Korean before taking formal Korean classes at a local university.

DL left Korea and went to Latin America to improve his Spanish in preparation for graduate school. He moved back to the U.S. to get an M.A.Ed., after which he got a job teaching at an American high school. Not enjoying either the job or living in the U.S., DL moved back to Korea, teaching at a private language school for a short time and then getting back into teaching at a Korean university.

AS was born and raised in India, where she graduated from university with a degree in computer management. Having been raised in India, her primary languages were part of her everyday life (English, Hindi, Marathi). After graduating university AS found that she did not want to work in the field which she had studied. She studied German for a year and then worked for an insurance company where German was required. After two years AS made the

decision to move to Korea, feeling that it would offer different options for a career. She worked with a gaming company as an English-to-German translator, and during this time she took Korean language classes, as well as doing occasional work in various sectors. At the time of the interview AS was working towards getting her Korean residency visa in order to have more options and freedom in Korea.

TY is from England. His interest in languages began as a child when he learned to count in Spanish. In university he took several courses in Japanese. He moved to Korea in the 2000s and he worked for a time in the public-school system. It was at this point that TY studied Korean independently, later studying for an MA TESOL. After receiving his MA, TY began teaching in the Korean university system and commenced his studies for his PhD. He actively participates in English teaching groups and organizations in Korea.

DM was born in the Canadian Maritimes and shortly thereafter moved to western Canada, where he grew up. His interest in languages began through seeing the writing system of Ancient Egypt in an encyclopedia. He copied some symbols onto note cards and traded them for some instruction in basic kanji from a Japanese-Canadian friend. He was not interested in French, despite it being a mandatory course in school.

As he moved through the education system he began to become interested in many topics, including learning languages. His initial plan was to study Japanese in university, but when it came time to enter university, he felt that he would not appreciably improve his level of Japanese as he had already achieved, on his own, quite a high level. Instead of attending university he decided to move to Japan, where he lived for two years working as a teacher and a translator.

While in Japan DM heard that Korean was a similar language to Japanese and he wanted to compare the two languages. He took a vacation from work and went to Korea for two months, where he threw himself into learning the language. After returning to Japan he found that he was not satisfied with his Korean level, so he again asked for time off from work; not receiving any, he quit his job in Japan and went back to Korea where he focused on learning the language more deeply. He lived in Korea for a few years before going back to Canada and studying other languages, becoming fluent in several.

In order to return to Korea and to qualify for a work visa DM needed a university degree, so he decided to major in French. At the time of his interview in this research he was working in Canada while applying for jobs in Korea.

8 Glossary of Terms

Bayesian—Descriptive of probabilities in which predictions can be changed when new information becomes available.

Hyperpolyglot—A person who speaks 6 or more languages at an intermediate level or above.

Machiavellian motivation—Motivation in which the driving force is not affiliation of the target language culture but, rather, to overcome the people of that culture

Pareto optimum—A condition in which no improvement can be made to a factor of a system without disadvantaging another factor. An optimal apportionment of resources.

Satisficing—Reaching a standard of 'good enough.' Descriptive of a level of acceptability rather than a maximized outcome.

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